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The Engineer.

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VOL. CXXXIII. —No. 3445] LONDON: FRIDAY EVENING, JANUARY 6, 1922 [PRICE {WITH SUPPLEMENT} ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

The High Commissioner for India is prepared to receive TENDERS for the SUPPLY of :—
BUFFERS.
ENGINE TURNTABLES.
Forms of Tender may be obtained from the Director-General, India Store Department, Belvedere-road, Lambeth, S.E. 1, and Tenders are to be delivered at that office not later than Two o'clock p.m. on Tuesday, the 31st January, 1922.
T. RYAN,
7100 Director-General.

Required for the Service of the GOVERNMENT of INDIA, an INSPECTOR OF CASTINGS at the Government Test House, Alipore. Candidates must be physically fit for service in India, of fair education and good moral character. Following qualifications essential :—Candidates to be between 25 and 35 years of age, of good address, must have served apprenticeship with a well-known firm of pipe founders, have a thorough knowledge of moulding generally, and be able to write intelligent reports. Candidate who has been foreman in an up-to-date works preferred.
TERMS.—Engagement for three years in first instance.
SALARY.—Rs. 450 per month, rising by annual increments of Rs. 25 to Rs. 750 monthly.
Further particulars and forms of application from the DIRECTOR-GENERAL, India Store Department, Belvedere-road, London, S.E. 1. Quote reference S. 21,367/1921 when applying. 7069

No. 00733 of 1921.
IN THE HIGH COURT OF JUSTICE
CHANCERY DIVISION
Mr. Justice Astbury
In the Matter of the AUSTIN MOTOR COMPANY LIMITED and in the Matter of the COMPANIES (CONSOLIDATION) ACT 1908.

Notice is Hereby Given that by an Order dated the 21st of December 1921 the Court has directed a Meeting of the Unsecured Creditors of the above Company other than
(1) Those claiming in respect of Preferential debts only
(2) Those whose debts are for less than £20
(3) The Railway Companies mentioned in Clause 12d. of scheme, viz.:—Great Western Railway Company Limited and the Midland Railway Company Limited
(4) Agents whose claims are in respect of deposits and/or rebates only and
(5) Those whose only debts are in respect of guarantees on cars delivered,
to be convened for the purpose of considering and if thought fit approving with or without modification a Scheme of Arrangement proposed to be made between the said Company and its unsecured Creditors and that such Meeting will be held at Winchester House, Old Broad Street, London on Friday the 27th day of January, 1922 at 12 o'clock noon at which place and time all the Unsecured Creditors other than those specified above are respectively requested to attend. A copy of the Scheme of Arrangement can be seen and forms of proxy obtained at the Registered Office of the Company, Longbridge Works, Northfield, Birmingham, between the hours of 10 a.m. and 2 p.m. on any weekday prior to the date appointed for the said Meeting. Such Unsecured Creditors may attend such Meeting and vote thereat either in person or by proxy provided that all forms appointing proxies are deposited with the Company at its registered office, Longbridge Works, Birmingham, aforesaid not later than 12 o'clock on the 26th day of January, 1922.
By the said Order the Court has appointed Francis Richard Wade of 1 Doctor Johnson's Buildings, Temple, London, E.C., or failing him Walter Henry Mandsley of 69 Cadogan Gardens, London, S.W., to act as Chairman of the said Meeting and has directed the Chairman to report the result thereof to the Court. The said Scheme of Arrangement will be subject to the subsequent approval of the Court.
Dated this 5th day of January, 1922.
LINKLATERS and PAINES,
2, Bond Court, Walbrook, London. 7092
Solicitors to the above-named Company.

Borough of Portsmouth.

MAIN DRAINAGE.—CONTRACT No. 8.
TO CONTRACTORS.
The Corporation of Portsmouth is prepared to receive TENDERS for the UNLOADING and CARTING from Fratton Railway Station, Portsmouth, and DISTRIBUTION along the site of the pipe track from Eastney Sewage Pumping Station to Fort Cumberland, of about 1500 TONS of 42in. diameter CAST IRON PIPES and about 80 TONS of SPECIAL CASTINGS; also for the LAYING, JOINTING and TESTING of about 1200 YARDS of 42in. CAST IRON STRAIGHT PIPES and BENDS.
Specification and form of Tender may be obtained and the drawings may be seen at the office of the Engineer, Mr. G. Midgley Taylor, of John Taylor and Sons, 36, Victoria-street, Westminster, S.W. 1, upon payment of £5 (cheque only), which will be returned upon receipt of a bona fide Tender.
Sealed Tenders, endorsed "Main Drainage. Contract No. 8," addressed to the Town Clerk, are to be delivered at his office at or before 9 a.m. on Friday, 20th January, 1922.
The Corporation does not bind itself to accept the lowest or any Tender.
F. J. SPARKS,
Town Clerk.
Town Clerk's Office,
Town Hall, Portsmouth,
2nd January, 1922. 7093

City of Manchester.

RIVERS DEPARTMENT.
The Rivers Committee are prepared to receive TENDERS for the SUPPLY and DELIVERY to their Davyhulme Sewage Works, Urmston (C.L.C.) of—
(a) Saddle-tank, 4-Wheeled Coupled Steam LOCOMOTIVE, 3ft. gauge, new or second-hand, (State cylinder dimension, stroke, wheel base, pressure insured to, maker, date built, price, and where locomotive may be inspected.)
(b) 20-Ton WEIGHBRIDGE, double scale, new or second-hand, suitable for motor wagon traffic, to be fixed at the Davyhulme Sewage Works, Urmston, in a position which may be inspected before tendering. (If second-hand, state name of maker and where weighbridge may be inspected.)
Parties tendering should give all the details asked for, with any other necessary particulars, including drawings or photographs of the machines offered.
Tenders should be addressed to the Secretary of the Rivers Department, Town Hall, Manchester, superscribed "Tender for ——," and be delivered not later than 10 a.m. on Monday, the 16th January, 1922.
By Order,
THOMAS HUDSON,
Town Clerk.
Town Hall, Manchester,
30th December, 1921. 7063

The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.

Progress of Engineering in 1921.
The Iron, Steel and Engineering Trades.
Aeronautics.
Railways.
Locomotives.
Commercial Shipbuilding.
Marine Oil Engines and Motor Ships.
Harbours and Waterways.

PUBLIC NOTICES

Bethnal Green Board of GUARDIANS.
CENTRAL HOT WATER SUPPLY.
The Guardians invite TENDERS for the INSTALLATION of a CENTRAL HOT WATER SUPPLY at their Hospital, Cambridge-road, E. 2.
Forms of Tender, specification, and drawing will be supplied by me upon application being made, together with a deposit of £3, which will be returned on receipt of a bona fide Tender.
Sealed Tenders, endorsed "Central Hot Water Supply," to be delivered at my office not later than Monday, the 6th day of February, 1922.
The Guardians do not bind themselves to accept the lowest or any Tender.
By Order,
C. FAULKNER JONES,
Clerk to the Guardians.
Administrative Offices,
Bishop's-road, Bethnal Green, E. 2,
3rd January, 1922. 7102

East Indian Railway.
The East Indian Railway Company is prepared to receive TENDERS for the SUPPLY and DELIVERY of—
MISCELLANEOUS TOOLS AND STORES,
as per specification to be seen at the Company's offices.
Tenders are to be sent to the undersigned, marked "Tender for Miscellaneous Tools, &c.," not later than Eleven o'clock a.m. on Wednesday, the 25th day of January instant.
The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason and does not bind itself to accept the lowest or any Tender.
For each specification a fee of £1 1s. is charged, which cannot under any circumstances be returned.
By Order,
G. E. LILLIE,
Secretary.
Nicholas-lane, London, E.C. 4,
4th January, 1922. 7108

Manchester Corporation Water- WORKS.
THIRLMERE AQUEDUCT.—FOURTH PIPE LINE.
The Waterworks Committee invite TENDERS for the LAYING and JOINTING of 54in. WELDED STEEL and other PIPES, the FIXING of VALVES and IRON-WORK, the CONSTRUCTION of SUBWAYS under railways, &c. and other work connected with the Fourth Pipe Line from Thirlmere to Manchester, as follows :—
CONTRACT "A."—Ambleside to South of Kendal (about 8½ miles).
CONTRACT "B."—Kirkby Lonsdale to Lancaster (about 8½ miles).
CONTRACT "C."—South of Lancaster to River Ribble (about 4½ miles).
CONTRACT "D."—River Ribble to Horwich (about 8½ miles).
Printed specifications, schedules of quantities, and forms of Tender may be obtained on application to the Secretary, Waterworks Offices, Town Hall, Manchester, on receipt of a deposit of Five Guineas for each contract, which will only be returned to the tenderer provided that he shall have sent in a bona fide Tender and shall have returned the documents lent to him. Plans and drawings may be inspected on application to the Waterworks Engineer. Only a limited number of the drawings being available, these, excluding ordnance maps, will be lent to persons tendering in priority of application, on payment of the sum of Three Guineas, which sum will not be returned.
Sealed Tenders, endorsed as directed in the schedules, must be delivered at the Waterworks Offices, Town Hall, Manchester, not later than the 9th of February, 1922.
By Order,
THOMAS HUDSON,
Town Clerk.
Town Hall, Manchester,
29th December, 1921. 7065

PUBLIC NOTICES

Tenders are Invited by the Government of New South Wales for the CONSTRUCTION of the SUPERSTRUCTURE and SUBSTRUCTURE of a CANTILEVER BRIDGE across Sydney Harbour from Dawes Point to Milson's Point, embracing a main span of 1600ft. in the clear, centre to centre of main piers, or 2600ft. centre to centre of anchor piers. The total length of bridge included in Tender is 3816ft., centre to centre of abutments. The deck of the bridge is to include four lines of railway, and a roadway 35ft. wide, between main trusses; and cantilevered outside the main trusses on the western side, a footway 15ft. wide, and on the eastern side a motor roadway 18ft. wide. Copies of specification, including plans, general conditions and schedule of quantities may be obtained on application to the undersigned.
To give any information required by tenderers, Mr. J. J. C. Bradfield, Chief Engineer, will be in London during June and July, 1922, address care of the undersigned.
Tenders in accordance with the specification must reach the Under Secretary for Public Works, Sydney, not later than 31st October, 1922.
AGENT-GENERAL
FOR NEW SOUTH WALES.
Australia House, Strand, London, W.C. 2,
December, 1921. 7086

The Bengal and North-Western RAILWAY COMPANY, LIMITED.
The Directors are prepared to receive TENDERS for the SUPPLY of :—
1200 VOLUTE SPRINGS.
550 C. and W. TYRES.
as per specification to be seen at the Company's offices.
Tenders, addressed to the undersigned and marked "Tender for Volute Springs," or as the case may be, are to be lodged not later than Noon on Monday, the 23rd day of January, 1922.
For each specification a fee of 10s. will be charged, which cannot under any circumstances be returned.
The Directors do not bind themselves to accept the lowest or any Tender.
By Order of the Board,
E. A. NEVILLE
Managing Director.
237, Gresham House,
Old Broad-street, London, E.C. 2.
4th January, 1922. 7107

The Great Indian Peninsula RAILWAY COMPANY.
The Directors are prepared to receive TENDERS for the SUPPLY of the following STORES namely :—

No.		Fee for Specification.
8.	SPARE PARTS for CARRIAGES and WAGONS (BUFFERS, BUFFER RODS and HEADS)	£1
9.	STEEL WORK for BRIDGES (100ft. spans)	£1

Specifications and forms of Tender may be obtained at this office on payment of the fee for the specification, which payment will not be returned.
The fee should accompany any application by post. Cheques and postal orders should be crossed and made payable to the Great Indian Peninsula Railway Company.
Tenders must be delivered in separate envelopes, sealed and addressed to the undersigned, marked "Tender for Buffers, Buffer Rods and Heads," or as the case may be, not later than Eleven o'clock a.m. on Tuesday, the 17th January, 1922.
The Directors do not bind themselves to accept the lowest or any Tender.
R. H. WALPOLE,
Secretary.
Company's Offices,
48, Copthall-avenue, E.C. 2,
London, 4th January, 1922. 7105

PUBLIC NOTICES

WEIGHBRIDGE.
The Corporation of Birmingham have FOR SALE :—
ONE WEIGHBRIDGE, 10-ton, by Avery and Co., platform 12ft. by 7ft., in perfect working order.
The weighbridge (for which a larger is being substituted) may be inspected at the Public Works Department Wharf, Coventry-road, Bordesley.
Offers to be addressed to the CITY SURVEYOR, the Council House, Birmingham, not later than the 16th January, 1922. 7067

Corporation of Calcutta.
APPOINTMENT OF EXECUTIVE ENGINEER, DRAINAGE.
(a) APPLICATIONS are INVITED for the POST of EXECUTIVE ENGINEER, DRAINAGE, Calcutta. The salary of the appointment, inclusive of all allowances, is Rs. 1300, rising to Rs. 1500 per month by annual increments of Rs. 50. The person appointed will be required to keep a motor car. The cost of a motor car will, if desired, be advanced by the Corporation and recovered in monthly instalments spread over three years.
The appointment is subject to the Provident Fund, leave and other service rules of the Corporation and may be terminated at any time by six months' notice on either side. The Provident Fund contribution is 8 1-3 per cent. of the monthly salary, and an equivalent amount is contributed by the Corporation and the fund accumulates at compound interest. The selected candidate will be under the direction of the Chief Engineer and be required to devote his whole time to the duties of his office and will not be allowed to take up any private work. He must reside in Calcutta. He will be liable to removal during the term of his office for misconduct or neglect of or incapacity for his duties. He will be required to submit to a medical examination before joining his appointment. The Corporation will pay his passage (1st class) from London to Calcutta, but he must refund the amount so paid, if he gives notice any time within two years from the date of taking up his appointment. He will be required to take up his appointment within two months of receiving notice of appointment and will receive half pay for the period occupied by the journey.
(b) Preference will be given to candidates who are Members or Associate Members of the Institution of Civil Engineers or Graduates in Engineering of a University, and have had experience in the design, construction and maintenance of sewerage projects for large cities, including pipe and masonry sewers, pumping stations, sewage treatment and disposal, as well as road and general construction works.
(c) Candidates are to state their age and experience.
(d) Applications will be received in the United Kingdom up to Monday, the 30th January, 1922, by W. C. Easton, Esq., B.Sc., M.I.C.E., 149, West George-street, Glasgow, from whom any other information concerning the conditions of service, &c., may be obtained.
B. V. RAMIAH,
Secretary to the Corporation.
Central Municipal Office,
The 8th December, 1921. 7011

Rangoon Municipality.
APPLICATIONS are INVITED for the APPOINTMENTS of TWO ASSISTANT ENGINEERS for the Public Works Department of the Rangoon Municipality.
AGE.—Preferably between 25 and 35 years.
QUALIFICATIONS.—Candidates should hold one of the following qualifications :—Membership or associate membership of the Institution of Civil Engineers, membership of the Institution of Municipal and County Engineers, or a degree in Engineering Science of any recognised University.
EXPERIENCE.—For one of the appointments it is essential that the candidate should have had considerable experience in the inception and execution of large water supply systems, sewerage systems, and sewage disposal works. For the other a general knowledge of municipal engineering, particularly with reference to road construction and maintenance on modern lines, surface water drainage and building construction.
SALARY.—The grade of the appointments is fixed at Rs. 600 to Rs. 1150 per mensem, rising by annual increments of Rs. 50 per mensem, plus a motor car allowance of Rs. 150 per month, but the initial pay of the appointment up to a maximum of Rs. 1000 per month plus car allowance will be fixed in accordance with qualifications and experience. The officer appointed will be eligible to subscribe to the Municipal Provident Fund after being confirmed in his appointment; subscriptions are payable at the rate of 8 1-3 per cent. of salary and an equal amount is contributed by the Municipal Committee. Compound interest is allowed according to amount earned by the Fund, usually 5 per cent. No exchange compensation allowance will be allowed. Other things being equal, preference will be given to those with approved war service.
Applications, stating age, present salary, if employed, whether married or single, and accompanied by copies of not more than three recent testimonials, will be received up to the 31st January, 1922, by the undersigned, from whom further particulars may be obtained.
OGILVY, GILLANDERS and CO.,
Agents for the Rangoon Municipality.
67, Cornhill, London, E.C. 3.
R. 2113. 7071

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SITUATIONS WANTED, Page II.
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For Advertisement Rates See Page 15, col. 1.

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SITUATIONS OPEN

WANTED by a Leading Boiler Insurance Company, additional BOILER INSPECTORS. Applicants must be practical engineers with a technical training, capable of making accurately dimensioned sketches of all classes of steam boilers and writing clear reports on conditions. Commencing salary £260 per annum, rising by annual increments to £400 per annum.—Address, 7070, The Engineer Office. 7070 A

WANTED, ENGINEER for Blast-furnace Plant. Must be experienced with Electric Power.—Address, stating age, experience, and salary required, 7095, The Engineer Office. 7095 A

WANTED, MANAGER for FOUNDRY, Capable of producing 30 tons a week. Salary £300 a year and commission.—Write, Box F4360, c/o Dawson's Advt. Service, 121, Cannon-street, E.C. 4. 7099 A

WANTED, Technically Trained ENGINEER, Accustomed to Patent Specifications, for London engineer's office; salary £265 p.a.—Address experience, &c., P4636, The Engineer Office. P4636 A

ENGINEER SALESMAN REQUIRED by Firm of Mechanical and General Engineers with head office in Scotland. Must have practical training as engineer and subsequent experience as salesman. Connection with food manufacturers a recommendation. Full particulars of experience, when free, and salary required.—Box No. 10, Brown's Advertising Offices, 166, Buchanan-street, Glasgow. 7072 A

ASSISTANT ENGINEER REQUIRED for Estimating and Contracts Department. Public school and university man preferred. Practical training and knowledge in design of Centrifugal and Turbine Pumps essential. Applicant should be energetic and fully experienced in pushing sales.—Apply, stating age, full experience, and salary required, to Messrs. W. H. ALLEN, SONS and CO., Ltd., Queen's Engineering Works, Bedford. 7091 A

INDIAN REPRESENTATIVE.—An important FIRM of IRON and STEEL MANUFACTURERS, having several rolling mills, also manufacturers of subsidiary goods, REQUIRE experienced REPRESENTATIVE for India. Only first-class men of the highest standing and having actual experience of Indian commercial life will be considered. State fully experience, age, and salary required, &c., in confidence.—Address, 7022, The Engineer Office. 7022 A

MANUFACTURERS of STEAM WAGONS and TRACTORS are OPEN to CONSIDER APPLICATIONS for the position of SALESMAN. Applicants must be able to furnish undeniable references as to character and capacity and state age, experience, and remuneration expected.—Address, 7113, The Engineer Office. 7113 A

REPRESENTATIVE for LONDON for Sale of Pumps; salary and commission. Good job for right man.—Address, 6979, The Engineer Office. 6979 A

REQUIRED for Engineering Works in London, MAN to Take Charge of and Operate Worm Gear Hobbing Machines. Applicants must have had previous practical and technical experience and be capable of securing best work and output.—Write, "ENGINEER," c/o Dixon's, 195, Oxford-street, W. 1. P4589 A

SECRETARY-DIRECTOR REQUIRED, Preferably with knowledge of Engineering, to control London office of provincial manufacturing company owning rapidly increasing business. Audited accounts show net profit of 56 per cent. p.a. on invested capital after payment of directors' salaries. Investment £2000. Salary £550 p.a. plus dividends. Open to solicitors' and accountants' investigation.—Write, Box 1355, Sells, 167, Fleet-street, E.C. 4. 7088 A

A FIRST-CLASS DRAUGHTSMAN WANTED for Electrical Engineering Works in London. Must have had a comprehensive experience in the design of up-to-date Switchgear and be capable of exercising initiative. A thorough works training and good electrical knowledge is essential. All applications will be treated as strictly confidential.—Address, stating age, experience, and salary required, 7081, The Engineer Office. 7081 A

DRAUGHTSMAN REQUIRED for Steel Structural Engineering Works, making all kinds steel-framed buildings. Able to do own calculations and details drawings. Salary £208 per annum.—Address, P4580, The Engineer Office. P4580 A

DRAUGHTSMAN REQUIRED for Scientific Instrument works; must be capable of carrying out experimental work and the preparation of drawings. He must have a good knowledge of engineers' requirements. State full particulars and salary required.—Address, P4640, The Engineer Office. P4640 A

FERRO-CONCRETE.—REQUIRED Shortly for the Midlands, a DESIGNING ENGINEER, good draughtsman, thoroughly experienced in the Design of Tanks, Bunkers, and Industrial Structures. University graduate preferred.—Address, giving full particulars, P4652, The Engineer Office. P4652 A

GOOD DESIGNING DRAUGHTSMAN REQUIRED; must be thoroughly conversant with Hydraulic Pumps, Presses, and Valves.—State salary required to ROBERT MIDDLETON and CO., Sheepscar Foundry, Leeds. P4645 A

LEADING DRAUGHTSMAN REQUIRED for Uniflow and Drop Valve Steam Engine Design; capable of taking full charge of department and working out general and detailed designs in accordance with latest developments.—Address, stating age, experience, and salary required, 7064, The Engineer Office. 7064 A

REQUIRED by Old-established FIRM of ENGINEERS in India, ONE STRUCTURAL and ONE MECHANICAL DRAUGHTSMAN, age about 25. Only single men with a thorough training and good experience need apply.—Reply fully, stating age, experience, and salary required, to Z. X. 401, c/o Deacon's, Leadenhall-street, London. 7017 A

WANTED, First-class FOREMAN for Scientific instrument manufacture, used to the control of men. Must have a sound knowledge of Machine Tools and the production of first-class precision work. State full particulars and salary required.—Address, P4641, The Engineer Office. P4641 A

WANTED for Birmingham District, Experienced FOREMAN for Wrought Iron Gate Department; must thoroughly understand high-class Hammered Wrought Ironwork and estimating cost of same. Charge 70/80 men.—Address, stating age, wages, and particulars, 7112, The Engineer Office. 7112 A

FOREMAN REQUIRED for Small Tool Works manufacturing principally Milling Cutters.
Applicants must have had thorough practical experience and a knowledge of the manufacture of Small Tools from the blank to the finished article.
An exceptional opportunity for the right man.
Address, with full particulars, P4647, The Engineer Office. P4647 A

BLACKSMITH WANTED for Important Colliery in New Zealand. Good employment guaranteed to suitable man. Applicants must have thoroughly good knowledge of Smithy Work in connection with Collieries.—Address, giving reference and copies of testimonials, P4648, The Engineer Office. P4648 A

TWO DRIVER FITTERS REQUIRED for D.C. Producer Gas Engine-driven Power-house in London. Must be capable and reliable men, accustomed to gas engines and able to take charge of shift.—Address, stating experience, age, and wages required, P4603, The Engineer Office. P4603 A

ESTIMATOR for Leading Manufacturers of Steel Windows and Constructional Steel Work. Good opening for clever man. State experience, age, and salary required.—Address 7066, The Engineer Office. 7066 A

SITUATIONS WANTED

ADVERTISER (35) SEEKS POSITION; Experience switches, crossings, lay-outs, steam, petrol locos., also pumps; 7 years charge D.O., 2½ charge small works; good references.—Address, P4629, The Engineer Office. P4629 B

AS ASSISTANT ENGINEER, MANAGER, or in any capacity where training would be of use. GENTLEMAN (31), married, fully trained mechanical engineer, urgently DESIRES POST. Good references; London preferred.
Fullest particulars on request. Open consider anything reasonable with prospects.
Address, P4616, The Engineer Office. P4616 B

BUYING ENGINEER.—The MANAGER of a Large Engineering Works Purchasing Dept., who has an exceptionally wide knowledge of the markets of the country, DESIRES to NEGOTIATE NEW APPOINTMENT.—Write, Z. M. 613, c/o Deacon's, Leadenhall-street, E.C. 3. 7098 B

CEMENT WORKS MANAGER REQUIRES POSITION; 30 years' experience in lay-out, erection and running of plants; also whiting and lime works. Extensive experience in quarrying and heavy machinery. Tactful in handling men. Good recommendations.—J. R. WARSAP, 116, Wokingham-road, Reading. P4608 B

CHEMICAL ENGINEER.—Installation, Maintenance and running of plant. Process management. Inspection or supervision of plant under construction. Experienced in control of labour. OPEN for immediate APPOINTMENT.—Address, P4621, The Engineer Office. P4621 B

CIVIL ENGINEER (35), Public School Man, Fourteen years' experience large contracts, including all methods boring, DESIRES POSITION of responsibility with progressive firm where energy and initiative are appreciated, home or abroad. Highest references.—Address in confidence, P4631, The Engineer Office. P4631 B

COMMERCIAL ENGINEER, Late R.E. Officer (32), with practical civil engineering and commercial experience at home and abroad, three years inspection and selling aircraft material, sound organising capabilities, DESIRES to negotiate APPOINTMENT.—Address, P4653, The Engineer Office. P4653 B

ENGINEER, Good Mechanic, Capable of Taking charge of a plant, electrical and otherwise, competent and willing, aged 38 years; now employed in London, but WISHES to be ENGAGED in the country.—Write, A. B. C., c/o Dixon's Advertising Agency, 195, Oxford-street, W. 1. P4625 B

ENGINEER GRADUATE, Present Assistant Works Manager, SEEKS better POSITION. Age 26. Organiser with initiative; modern manufacturing and repair methods; exceptional experience.—Address, P4618, The Engineer Office. P4618 B

ENGINEER (Mechanical and Electrical), Having held prominent appointments amongst large works in Lancashire and Yorkshire during past 18 years, is DESIROUS of REPRESENTING two or more substantial FIRMS in these districts.—Write, "R. M.," c/o J. W. Vickers and Co., Ltd., 5, Nicholas-lane, E.C. 7089 B

ENGINEER, Mechanical, Electrical, Fully qualified, WISHES to REPRESENT FIRM of repute, home or abroad; outside contracts. Capable planning, supervising, erection and testing. Full particulars, experience and bona fides.—Address, 6983, The Engineer Office. 6983 B

ENGINEER (27), Practical Experience in boiler, engine fitting, coppersmiths' and moulders' shops, sound technical training at Admiralty technical institutes, and D.O., DESIRES POST as BOILER and ENGINE INSPECTOR or any post promising scope for ability and advancement.
Address, P4630, The Engineer Office. P4630 B

ENGINEER (29) REQUIRES Progressive POSITION with firm of engineers; experienced foreman of maintenance, travelling, erector, head examiner, also charge experimental dept., agricultural tractors, good steam and general experience.—Address, P4651, The Engineer Office. P4651 B

ENGINEER (24) SEEKS APPOINTMENT; Considerable experience in maintenance of modern steam plant, pumping, condensing, and evaporating machinery, electric light engines, heating plants, oil and coal-fired boilers, &c. Competent draughtsman, exceptional technical experience; excellent references. Take any post with prospects, commercial or practical.—Address, P4619, The Engineer Office. P4619 B

ENGINEER, Willing to Take Work Anywhere, engines, gas, oil, suction, and electrical plants, also printing machinery. Good references.—Address, P4604, The Engineer Office. P4604 B

INSPECTOR.—ENGINEER, Doing Inspection and testing, also coal inspection in South Wales districts for foreign Governments, is PREPARED to TAKE on similar additional WORK for those who are not represented here.—Address, P4626, The Engineer Office. P4626 B

LABORATORY ASSISTANT (Mechanical). Long experience in all branches of testing and inspection of materials, REQUIRES similar POST London, district; excellent references.—Address, P4611, The Engineer Office. P4611 B

MECHANICAL ENGINEER, A.M.I. Ae. E., Age 31, 16 years works, D.O., administrative, DESIRES POSITION as Assist. Works Manager, Dept. Manager, or similar post, at home or abroad. Varied experience, general, I.C.E., and small parts production. Patentee. Progressive position more important than high salary.—Address, P4610, The Engineer Office. P4610 B

MECHANICAL ENGINEER, Single, Age 23, First-class experience steam turbines and reciprocating engines, fire tube and water-tube boilers design, erect and test any steam plant. Engineering course, London University, Inter. B.Sc. Eng. degree. Sea experience. Fluent French. Willing to go abroad.—Address, P4612, The Engineer Office. P4612 B

MECHANICAL ENGINEER, with Good All-round general experience (works and office), SEEKS RE-ENGAGEMENT as Manager or other responsible post.—SNOAD, 36, York-road, Hitchin. P4644 B

TECHNICAL ENGINEER (32), B.Sc. Eng. (Lond.), A.M.I. Mech. E., general engineering experience, DESIRES POST in any capacity.—Address, P4643, The Engineer Office. P4643 B

WORKS MANAGER, Age 42, Live Man who can reduce costs, shortly DISENGAGED; used to good class light and medium work.—Address, P4627, The Engineer Office. P4627 B

DRAUGHTSMAN (40) DESIRES BERTH; 5 Years' shops, 20 years' D.O. general experience, 6 years leading draughtsman; London district preferred.—WHITEHEAD, 5, Castletown-road, West Kensington. P4646 B

DRAUGHTSMAN (Electrical Mechanical), Aged 23, REQUIRES SITUATION; experienced in design small dynamos and motors, heating appliances, factory lay-out, lighting. Adaptable; excellent references.—Write, GEL, 62, Lower-road, S.E. 16. P4605 B

DRAUGHTSMAN, 14 Years' Experience Works and drawing-office, mechanical and general engineering structure detail and rolling stock design; age about 30.—Address, P4620, The Engineer Office. P4620 B

SITUATIONS WANTED (continued)

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For continuation of Small Advertisements see page iii

THE ENGINEER.

DECEMBER.

Progress of Civil Aviation.

THE fifth half-yearly report on the progress of civil aviation at home and abroad, issued by the Air Ministry at the end of the month, recorded a considerable expansion of air traffic, particularly in France, Belgium and Holland. With regard to the British cross-Channel services, the report stated that the Government's subsidy scheme had been amplified to the extent of providing an additional grant of £3 per passenger and 3d. per pound of freight, while a contribution of 50 per cent. of the cost of insurance of the machines would be made by the Air Ministry. Under the original scheme, the firms operating the services receive a grant of 25 per cent. of their gross earnings, and are enabled to acquire a portion of their fleet from the Government on very generous hire-purchase terms. With the additions now made, the Government's encouragement of civil aviation can hardly be expected to go farther. Three firms have been chosen to operate the London-Paris route, with possible extensions to Manchester and Basle or Zurich, while a fourth has been chosen to work the London-Brussels route. The question of operating the London-Amsterdam route is, at present, in abeyance. According to the report, arrangements are being completed whereby the Croydon-Lympne route could, at short notice, be opened for night flying. The means to this end consist of a chain of aerial lighthouses and pilotage lights and an automatic apparatus half-way towards the coast to indicate, by a system of coloured lights, the strength and direction of the prevailing wind. Experiments, it is stated, are being carried out with satisfactory results into the possibility of using radio-telephony for the purpose of directing aircraft into an aerodrome during foggy weather. In the statistical section of the report it is recorded that during the six months from April 1st to September 30th, 671 British machines arrived and departed on the continental services, and that 4006 passengers were carried by them. Imports by air amounted to £206,357 in value, and exports to £110,400. The number of outgoing letters posted for transmission by air mail was 42,840. As regards efficiency, a considerable improvement is reported in that 95 per cent. of the scheduled outward flights were completed within four hours of the time of departure.

French Submarines.

THE recent refusal of the Senate to accept any reduction in the number of submarines below what is believed necessary for the national defence is fully in accord with the attitude of France generally, which has always regarded the undersea craft as indispensable for ensuring the country against hostile attack. From the time of Admiral Aube down to the Ministry of M. Camille Pelletan the submarine gained steadily in popularity, but the propaganda having been carried to an excess there was a reaction in favour of battleships, which, however, has given way once more to a preference for submarines as offering the most effective and economical arm when the country's finances will only permit of a limited expenditure. The development of aviation has also reconciled the French to the partial suppression of capital ships, for they are convinced that with submarines, seaplanes and fast cruisers they will be able to keep their coast line intact and at the same time ensure safe communication across the Mediterranean, which is regarded as absolutely essential to national existence. There is a feeling in France at the present time that no political guarantee is as safe as the protection of her own fleet, and, moreover, there is a reluctance to sacrifice the naval traditions of the past and accept a subsidiary position amongst naval Powers. For those reasons France proposes to continue to build submarines, for which she expected to be given a free hand in exchange for her acceptance of a reduction in the tonnage of capital ships, which she did not particularly want.

Railway Rates.

ON the 20th of the month the secretary of the Railway Clearing House announced that the general managers of the English and Welsh railway companies had been much impressed by the arguments put forward by the various deputations that had waited on them on the subject of a reduction in rates. Responding to the appeal of many that "every little helps," they had agreed to the rates for coal, coke, limestone for chemical works, lime for iron and steel making, and iron and steel of Class B being reduced from 100 per cent. above pre-war figures to 75 per cent. above, and to the flat rate of 6d. per ton to be reduced to 4d. The change was to be made on January 1st, but, in view of the uncertainty of the future, the reductions were to be applied experimentally for twelve months. Another small concession—also to be reviewed at the end of twelve months—is the restoration of the pre-war free periods for loading and unloading wagons. The restricted demurrage conditions, now modified, were those imposed during the war, when there was a scarcity of wagons, in order to get them more quickly back into traffic. The semi-official announcement on this further concession said that it meant that traders would save charges for demurrage to the extent of one million days per annum.

Our Water Power Resources.

THE final report of the Committee which was appointed in 1918 by the President of the Board of Trade to inquire into the water-power resources of the United Kingdom was published in the middle of the month. The recommendations of the majority of the Committee fall under two main heads, first, the general control of water supplies, and, secondly, the control of water for power purposes. It is recommended that there should be established a Water Commission for England and Wales, the duties of which should include the compilation of data, the allocation of water rights in the interests of the community, and—amongst other things—the grouping of the country into areas and the setting up in those areas, when necessary, of watershed boards in substitution of the various existing local controlling authorities. It is not considered that Scotland, in view of the abundant nature of the supplies available and for other reasons, that control is needed, but the Irish sub-committee recommends a controlling authority on somewhat similar lines to those proposed for England and Wales. The Committee considers that in Great Britain power to the extent of 210,000 kilowatts could be developed continuously from potential water powers at an economic rate. That figure is equal to about 40 per cent. of the total units generated during the year 1917–18 with 410 steam power electric generating stations in the country, and represents the equivalent of some 3,000,000 tons of coal. Ireland is said to possess potential water power to the extent of 280,000 kilowatts continuous. The proposal is made by which all licences or rights granted in respect of water power, which would normally be for 100 years, would eventually revert to the State. Other points dealt with in the report were river pollution, fishing rights, compensation water and land drainage.

State Monopolies.

THE failure of State monopolies in a country in which they have always existed is one of the most characteristic examples of the general tendency nowadays to leave all enterprise of an industrial character to private initiative. During the month the former French Under-Secretary of State for Posts and Telegraphs, M. Deschamps, made repeated attacks upon the hopelessly inefficient methods of the State in its business undertakings, and while admitting that the postal service must, for obvious reasons, remain in the hands of the State, he insists that the telephone and other monopolies should be transferred to private companies. Concessions for wireless telegraph installations have been granted to private concerns, a thing that would have been regarded as out of the question a few years ago, and now the State Railways are to be handed over to a company, of which two-thirds of the capital are to be subscribed by the public and the remainder by the departments and communes. The failure of the State management of railways is so obvious that it can be no longer ignored. Except, perhaps, for the express trains, the service on the old Ouest Railway has never been so bad as it is now. The State has embarked upon costly improvements which are being held up more or less for want of funds, and the only hope for the future of the system lies in its entire transference to a company constituted with public capital and run by business people. If the State monopolies have fallen upon such evil times, it is largely due to the lamentable results of State management during the war.

A Waterworks Power Plant.

A HYDRO-ELECTRIC plant, which, though comparatively small in size, possesses considerable interest, was formally put into service in the early part of the month. The Corporation of Bradford is about to build a dam, to be known as the Scar House dam, with the object of increasing its water storage capacity by the creation of an additional reservoir in the valley of the river Nidd. With the object of providing the power necessary for working the cranes, overhead ropeways, crushing plant, concrete mixers and the other plant which will be required for the construction of the new dam, it was decided to make use of the energy in the water as it makes its way from the existing Angram reservoir to the supply conduit, by passing it through turbines coupled to alternate current generators. The net average working head is 168ft., but the turbines, which are of the Francis type and work at 1000 revolutions per minute, are also capable of working under heads up to 207ft. with the same output and correspondingly reduced discharges, and under heads down to as low as 148ft. with correspondingly reduced outputs. The power-house contains two complete generating units, each of the two turbines being coupled direct to an open-type three-phase generator with an overhung exciter. The generators are designed for a continuous output of 250 k.V.A., or 200 kilowatts at 0.8 power factor, 2400 volts 50 cycles. The current is conveyed by overhead transmission wires to sub-stations of which, when the undertaking is in full operation, there will be four. Two of these sub-stations will contain four and one sub-station five 50 k.V.A. transformers, which will reduce the pressure from 2200 volts to 440 volts. The fourth sub-station, in addition to a transformer, will contain a 20-kilowatt motor generator, a belt-driven generating unit of 20-kilowatt capacity operated by a 35 horse-power hot-bulb crude oil engine, and a battery of 60 cells in glass boxes. It may be mentioned that the water, after doing its work in the turbines, flows down the aqueduct to Bradford.

The End of the L. and Y. Railway.

A YEAR ago, on the page corresponding to this in our issue of January 7th, we alluded in our engineering notes for December, 1920, to the appointment of Mr. Arthur Watson, the general manager of the Lancashire and Yorkshire, to be the general manager of the London and North-Western also. At

that time the principle of grouping, put forward by the Minister of Transport in June, 1920, in his outline of policy, had been generally accepted by the railway companies. Therein the Lancashire and Yorkshire was to go into the same group as the London and North-Western, and Mr. Watson's appointment was regarded as in anticipation of this event. The two companies did not, however, wait for Sir Eric Geddes' Bill, but, on the eve of Easter, announced that terms of amalgamation had been agreed. The Railways Act, under Sections 7 and 8, gave the necessary powers for such an amalgamation. The scheme has—Section 7 (2)—to be approved by the proprietors and debenture stock holders, and—Section 8 (3)—by the Railway Amalgamation Tribunal. On December 20th this last stage was reached, and formal approval was given by the Tribunal. It was then announced that the amalgamation would come into force as from January 1st, 1922. For operation, the combined railway has been divided into two divisions—a northern and southern—with Crewe as the dividing point. Euston will be the headquarters of the southern division, and the former chief offices of the Lancashire and Yorkshire at Manchester the headquarters of the northern division. The civil engineering for the combined system is under Mr. E. C. Trench, and the mechanical engineering under Mr. George Hughes.

The Completion of the Simplon Tunnels.

ON Sunday, December 4th, the last keystone in the Italian portal of the second of the twin Simplon tunnels was put in position, a work which marked the final completion of an enterprise which has been under more or less active construction for a period of some twenty-three years. Of course, as all the world knows, one of the twin tunnels has been in successful service for many years now. It was when the finishing touch was put to the second that the successful termination of a wonderful engineering undertaking was celebrated on that Sunday at the beginning of last month by a ceremony which was participated in by Swiss and Italian engineers, and which included the laying of a wreath on the stone reared at Iselle in memory of those who had lost their lives in the work. The first tunnel was completed, so far as the masonry was concerned, in 1905, and it was opened for traffic on June 1st, 1906. Alongside it had been pierced a second "gallery" of smaller cross section, which was always intended for the second tunnel, but which was at first used for ventilation purposes only. Its enlargement so as to make it of sufficient size for the passage of trains was begun in 1912, and it was originally surmised that it would take four years to complete. That that period has been very considerably exceeded is due, of course, to the war. In no other tunnel have so many dramatic situations been encountered, nor so many seemingly insurmountable obstacles met with as has been the case of the Simplon. During the construction of the first of the twin tunnels we described the progress made and the difficulties overcome in very considerable detail; it is satisfactory to be able to record that in the second tunnel there were not nearly so many untoward happenings as in the first, the relative immunity being no doubt due to the experience gained in the latter.

Hydro-Electric Supply.

THE idea of our French friends that they will be able to dispense with imported fuel by utilising the hydraulic energy with which the country is so plentifully supplied is not working out so well as they had anticipated. It is true that the circumstances are exceptional, and that it is difficult to imagine that we shall experience other years of such exceptional drought as the one through which we have passed; but the fact that a prolonged period of dryness should seriously diminish the sources of energy is sufficiently disquieting to raise doubts whether it is prudent to rely entirely upon hydraulic power. For some considerable time now, industrial activity in the Department of the Isère has been partly arrested by the inability of the hydro-electric companies to distribute sufficient current. During the past month many of the works—in fact, the greater number—have only been supplied with energy for about three days a week. Now it is reported that the glaciers in the Alps are receding, and that some of the mountains, which have always been covered with "perpetual snow," are now bare, while most of the rivers are so low that they provide a wholly insufficient head of water. These conditions suggest that the shortage of water power may continue for a considerable time, and they are causing a great deal of uneasiness amongst hydraulic engineers, who admit that consumers should have steam or gas engines as a stand-by, a condition which, of course, appreciably reduces the economy of the hydro-electric supply.

Iron, Steel, Coal and Engineering Trades in 1921.

No. I.

THE year that has just slipped away must be written down as the grave of the bright hopes of its predecessor, so far as the experiences of the iron, steel, coal and engineering industries are concerned. When 1920 came to a close, the flash-in-the-pan post-war boom had been a thing of the past for three months at least and in its place had come a trade slump. The general view of business men, however, was that the spring of 1921 would witness another industrial and commercial recovery, and that this time it would be the real and lasting thing. Alas! the hoped-for revival did not materialise, and the year went out in deeper gloom than that which shadowed its entry.

True, in the first quarter almost superhuman efforts were made to get things on the move again, but such an event as the British Industries Fair proved beyond doubt that buyers required an inordinate amount of coaxing to place even comparatively small orders. Perhaps by the spring the outlook was clearing a little, and, carefully handled and husbanded, the trade position for steel and its allies might have become in a measure satisfactory; but just as the bare hope of it was being entertained, the colliers of the country decided upon a course which destroyed whatever British trade was then struggling for existence. In this resolve they called for the active assistance of the railwaymen and the transport workers, and for a moment it looked as if nothing could save a strike by the Triple Alliance of Labour, but in the end the miners were left to fight alone.

For three months they laid the pits idle, and many of them they saw "drowned out" rather than permit the safety men to continue at work. But it was in the country's general trade that the greatest destruction was wrought. The loss was incalculable. What six months of slump had failed to do, half that time spent in the coal strike accomplished to the full. British commerce, and particularly the iron, steel and engineering industries, reeled almost to the point of absolute ruin. The nation's great coal export trade passed into foreign hands, and we became importers of fuel and heavy buyers on the Continent of the iron and steel which hitherto we had made for ourselves.

These troubles were accentuated by the abnormal state of foreign exchange rates, which, so far as most continental countries were concerned, made competition with rivals on the other side of the Channel well-nigh impossible. Then, again, although a country like France was in need of many iron and steel manufactures with which we could have supplied her—and would have done in normal days—her financial condition was so crippled by the prolonged war, and she had to pay double in francs for anything she bought from us, that she simply had to keep out of the market, to our serious loss. In spite of these extraordinary drawbacks, however, British steel and engineering firms won some notable contracts in face of the keenest competition in the world markets, though, if the truth were told, the orders were secured at figures which brought work to the home factories, but little or no profit to the firms undertaking them.

Lower Costs of Production.

The settlement of the coal strike in June still left the labour atmosphere charged with anxiety, for the engineering trade was seething with disagreement on the question of the inevitable deflation of war bonuses. The negotiations were very protracted, but eventually were satisfactorily terminated. Employers went everywhere preaching the gospel of lower costs of production and urging to that end a fall in the cost of fuel, lower railway rates, and further wage deflations, beside, of course, relief from the burden of over-taxation.

For a time these warnings appeared to have no effect, but gradually the desired changes began to develop. The obnoxious E.P.D. was ended, though there are still heavy arrears owing by many firms; a certain degree of relief has come in the matter of railway rates, yet still inadequate; the price of manufacturing coals has fallen appreciably; iron and steel quotations are now too low to make it profitable for continental producers to sell in our market; the Bank rate has dropped to 5 per cent.; our coal exports are gradually being won back, though often at pit prices which mean an absolute loss to the coalowner; and, most important of all, the trade unions are beginning to take a sane view regarding the question of war bonuses. Much as they, quite naturally, desired to retain them until they became part of the recognised standard wages, they were brought at last to the conviction that with prices in almost every other direction on the decline it was utterly impossible for employers to proceed further with their programmes for winning back home and overseas trade unless labour was willing to contribute its quota toward a reduction in the cost of production.

Substantial progress had been made along these lines by the end of the year, but much more remains to be done before our manufacturers and exporting houses can hope to regain a firm foothold in the various oversea markets. The fact is that while wages are still comparatively high in this country, fewer hours per day are worked than in the countries of our chief competitors, and the output per man per hour is still seriously below par. What appears probable, therefore, is that unless the workers can themselves discover some specific for raising the rate of production, the operation, which is a vital necessity if the commercial life of the nation is to be saved, will have to be effected by a general lengthening of the worker's day. That seems to be the only alternative.

One of the gravest problems in 1921 was that of unemployment, and it, of course, is still acute. A small improvement had been brought about in the early part of the year, but the national coal strike plunged the country deeper into the mire, and although the army of unemployed began to be reduced again in July, the progress was very slow. Schemes to alleviate the acuteness of the position were discussed in Parliament, and three or four different measures, which seemed to be appropriate, were agreed to. For one thing, it was decided that the Admiralty should proceed at once with the building and equipping of four battle-cruisers—huge vessels of the Hood type. Whilst such a step bore no relation whatever to real trade recovery, it was fully recognised that it would form a valuable industrial background and would provide work for a large number of people for a year or so, by which time, it might be expected, an actual trade revival would have developed. The contracts were placed and subcontracts arranged, but at that point the proposals of the Washington Conference regarding reductions of naval armaments were announced, and as the British representatives agreed in principle with them, work on the new capital ships was suspended, much to the disappointment of armament centres like Sheffield, the Tyne, and the Clyde.

Trade Recovery Arrested.

However desirable the Washington proposals may be in the long run, the immediate effect of the suspension or cancellation of the naval contracts was that the bottom seemed to fall right out of the trade recovery movement, and once again the number of the unemployed began to rise. As the end of the year approached, the position showed few signs of improvement, and although the motor and motor cycle shows at Olympia appeared to do very much good in the resuscitation of the trades concerned, which had been suffering severely from the slump, few people are now pinning their faith to any earlier date than the spring for the beginning of a general trade recovery. In the meantime, there are streaks of activity in the heavy engineering departments, particularly noticeable, perhaps, in the construction of electrical plant, in the erection of rolling mill machinery and the production of hydraulic presses. Railway work was one of the year's disappointments, as to quantity, but taking home and overseas orders together, a fair number of contracts for the building of locomotives and goods and passenger rolling stock were placed in this country; but so enormously has the capacity of production been increased here during and since the war that it is safe to say our rolling stock builders could with ease double the size of their order books without giving themselves any anxiety regarding delivery.

A remark of that description applies in many other directions, notably in the melting of steel. The number of open-hearth furnaces has been multiplied in quite a wonderful manner, whilst in most unexpected quarters electric steel-melting furnaces have been installed. Most of these furnaces are at the moment standing idle, but when the resumption of full operations is again possible it will probably be found that the increase in the number of blast-furnaces has been permitted to fall very much into arrears—to such an extent, in fact, that unless something is done soon to readjust the position, consumers may be thrown more than ever on foreign resources. Against that view, of course, there must be placed the fact that greater scientific knowledge is enabling much better results to be obtained from the existing blast-furnaces, the product of which, in very many cases, passes direct, *viâ* the mixer, into the steel furnace without the intermediate pig-making process. Nevertheless, that additions to the present number of blast-furnaces will be required is certain.

The year was productive of at least one important discovery, viz., that of rustless iron, which, being practically carbon free, is easily worked up into a wider variety of articles than is possible with stainless steel. As in the case of the latter, the new material is a Sheffield product, for which, it is believed, there is an extraordinary future.

The Deflation of Prices.

Throughout the twelve months certain outstanding features characterised the whole of the iron, steel and engineering centres, so that the ground traversed in this general introduction applies almost equally to each of the industrial sections dealt with below. Regarding the price deflation which has occurred in iron and steel material, non-ferrous metals and fuels, it was considered best to present a comparison by means of tables showing, in some instances, the position at different periods of the year, and in others the extreme figures—highest and lowest—reached

during the twelve months. In reading the quotations of iron and steel, it should be remembered that for reasons of space, where odd sixpences occurred in the prices they have been omitted, and that where two quotations were given at any particular date—as, for example, £10 to £12—instead of striking a middle figure, viz., £11, the lower quotation has been used in all cases. With these explanations we will proceed to present tables showing the manner in which prices were deflated during the year. These facts are also shown in a broad way by the curves given on page 5.

IRON ORE.

NORTH-WEST COAST.

	Jan. 7.	April 1.	July 1.	Oct. 7.	Dec. 30
	s. d.	s. d.	s. d.	s. d.	s. d.
Native	59 0	49 0	49 0	37 0	37 0
Spanish	50 0	39 0	39 0	28 0	28 0
N. African	50 0	39 0	39 0	28 0	28 0

NORTH-EAST COAST.

Foreign	49 0	37 6	37 6	28 0	26 0

PIG IRON.

SCOTLAND.

	Jan. 7.	April 1.	July 1.	Oct. 7.	Dec. 30.
	£ s.	£ s.	£ s.	£ s.	£ s.
Hematite	13 5	9 0	9 0	7 15	6 0
No. 1 foundry	13 5	8 10	8 10	7 10	6 0

NORTH-EAST COAST.

Hematite	13 0	9 0	8 0	6 10	5 0
No. 1 foundry	13 2	9 2	8 2	6 12	5 2

CLEVELAND.

No. 1 foundry	11 17	7 15	6 15	—	5 5
G.M.B.	11 5	7 10	6 10	6 0	5 0
No. 4 forge	11 5	7 7	5 17	5 12	4 10
Mottled	11 5	7 7	5 17	5 10	4 5
White	11 7	7 5	5 15	5 10	4 5

STAFFORDSHIRE.

All-mine	19 5	18 10	17 0	17 0	15 0
Part-mine forge	12 17	8 10	8 0	—	—
Part-mine foundry	13 10	9 0	9 0	—	5 10

NORTHAMPTON.

Foundry, 1 and 2	12 5	8 5	8 10	—	Nom.
Foundry, 3	12 0	8 0	8 5	6 5	4 15
Forge	11 5	7 0	6 17	—	4 4

DERBYSHIRE.

No. 3 foundry	13 0	8 0	8 15	6 10	12
Forge	12 0	7 10	7 0	6 0	4 5

LINCOLNSHIRE.

Basic	13 17	—	—	—	Nom.
Foundry	13 0	—	—	—	Nom.
Forge	12 2	—	—	—	Nom.

NORTH-WEST COAST.

Hematite	13 15	9 0	8 0	7 5	6 5
Hematite, special	15 0	11 0	9 0	—	—

MANUFACTURED IRON.

SCOTLAND.

	Jan. 7.	April 1.	July 1.	Oct. 7.	Dec. 30.
Crown bars	27 10	23 0	16 0	14 0	12 10
Best bars	31 0	31 0	31 0	17 0	17 0

NORTH-EAST COAST.

Crown bars	27 10	23 0	16 0	14 0	12 10
Best bars	31 0	24 0	17 0	18 0	18 0
Tees	31 10	31 10	31 10	14 10	14 10

LANCASHIRE.

Crown bars	28 0	22 0	16 0	14 0	13 0
Hoops	28 5	26 5	20 5	17 5	16 5

SOUTH YORKSHIRE.

Crown bars	28 10	24 10	16 0	16 0	13 0
Best bars	29 10	25 10	17 0	17 0	14 0
Hoops	28 5	23 5	20 5	17 5	15 5

MIDLANDS.

Marked bars	33 10	27 10	22 0	20 0	16 0
Crown bars	28 10	24 10	16 0	16 0	12 10
N. and B. bars	28 10	22 0	16 0	15 10	12 5
Black sheets	25 0	20 0	18 0	17 0	—
Galvanised sheets	30 10	24 0	22 0	20 0	—
Gas tube strip	32 0	26 0	22 0	17 10	13 10

STEEL.

SCOTLAND.

	Jan. 7.	April 1.	July 1.	Oct. 7.	Dec. 30.
Boiler plates	31 10	25 0	20 0	19 0	14 0
Ship plates	25 10	19 0	15 0	14 0	10 10
Sections	24 10	17 10	14 10	13 10	10 0
Steel sheets	29 0	22 0	19 10	15 5	12 5
Galvanised sheets	33 0	26 0	26 0	24 0	17 0

NORTH-EAST COAST.

Ship plates	24 10	19 0	15 0	14 0	10 10
Angles	24 0	17 10	14 10	13 10	10 0
Boiler plates	31 0	25 0	21 0	19 0	16 0
Joists	24 0	17 10	14 10	13 10	10 10
Heavy rails	25 0	18 0	15 0	12 10	9 10
Fish-plates	30 0	23 0	20 0	19 0	14 10
Channels	24 5	20 0	20 0	14 10	14 10
Hard billets	23 10	15 0	12 10	11 0	9 10
Soft billets	21 10	14 10	12 0	9 10	7 10

NORTH-WEST COAST.

Heavy rails	23 0	18 0	15 0	14 0	11 0
Light rails	25 0	21 0	18 0	16 0	13 0
Billets	18 0	18 0	15 0	13 0	9 10
Ship plates	24 10	19 0	15 0	14 0	10 10
Boiler plates	29 0	26 0	21 0	20 0	16 0

MANCHESTER.

Round bars	25 0	16 0	14 0	12 0	10 0
Other bars	24 0	17 0	15 0	13 0	11 0
Hoops, best	30 5	28 5	20 5	17 5	15 5
Hoops, soft	27 5	23 0	17 5	14 5	12 5
Plates	26 0	18 0	15 0	12 0	10 0
Plates, Lancs. boiler	31 0	27 0	21 0	19 0	16 0

SHEFFIELD.

Siemens acid billets	26 0	20 0	20 0	16 0	13 0
Bessemer billets	25 10	19 10	19 10	15 10	12 10
Hard basic	21 0	18 0	15 0	11 0	10 0
Soft basic	20 0	14 10	14 0	8 10	8 10
Hoops	27 5	20 5	17 5	14 5	13 5
Wire rods	21 10	—	—	13 15	10 0

STEEL (*continued*).

MIDLANDS.

Mild rolled bars	21 0	16 10	13 16	11 10	10 0
Bessemer bars	16 0	12 10	12 0	7 10	7 10
Bessemer billets	16 0	12 10	12 0	7 10	7 10
Hoops	26 15	18 10	18 10	14 0	12 0
Tube strip	32 0	18 10	17 0	12 0	10 15
Angles and joists	24 0	17 10	14 10	13 10	10 0
Tees	—	18 10	15 10	14 10	11 0
Bridge plates	—	16 0	15 0	14 0	10 10

NON-FERROUS METALS.

SWANSEA.

	Highest.	Lowest.
	36s.	20s.
Tin-plates, I.C., 20 by 14		
Block tin (cash)	£205 10 0	£169 15 0
Block tin (three months)	210 10 0	171 10 0
Copper (cash)	72 0 0	66 12 6
Copper (three months)	73 5 0	67 12 6
Spanish lead (cash)	25 10 0	24 10 0
Spanish lead (three months)	25 0 0	24 12 6
Spelter (cash)	27 10 0	26 5 0
Spelter (three months)	27 15 0	26 18 9

MANCHESTER.

Copper, best selected ingots	81 0 0	69 0 0
Copper, electrolytic	82 0 0	74 0 0
Copper, strong sheets	130 0 0	98 0 0
Copper, locomotive tubes	0 1 5½	0 1 2½
Brass, locomotive tubes	0 1 3½	0 1 0½
Brass, condenser	0 1 7½	0 1 4½
Lead, English	27 0 0	26 5 0
Lead, foreign	25 10 0	24 10 0

FUELS.

CARDIFF.

Export.	Highest.	Lowest.
	s. d.	s. d.
Steams:		
Best smokeless large	80 0	25 6
Second smokeless large	72 6	25 0
Best dry large	77 6	25 6
Ordinary dry large	70 0	24 6
Best Black Vein large	72 6	23 6
Western Valley	67 6	23 0
Best Eastern Valley large	67 6	23 0
Ordinary	65 0	21 6
Best steam smalls	50 0	18 0
Ordinary	40 0	12 6
Washed nuts	62 6	35 0
No 3 Rhondda large	80 0	29 0
No. 3 Rhondda smalls	50 0	20 0
No. 2 Rhondda large	60 0	24 0
No. 2 Rhondda through	50 0	20 0
No. 2 Rhondda smalls	40 0	15 0
Coke (export)	100 0	35 0
Patent fuel	75 0	25 0
Pitwood (ex ship)	50 0	32 6

Export. SWANSEA.

Anthracite:		
Best large	100 0	57 6
Seconds	95 0	52 6
Red Vein	85 0	47 6
Big Vein	85 0	55 0
Machine-made cobbles	105 0	72 6
Nuts	105 0	72 6
Beans	80 0	58 6
Peas	80 0	20 0
Breaker duff	25 0	7 9
Rubbly culm	32 6	11 0
Steams:		
Large	75 0	24 0
Seconds	70 0	23 0
Smalls	40 0	12 6
Cargo through	50 0	20 0

Inland. SHEFFIELD DISTRICT.

S. Yorkshire best steam,hards	33 8	25 0
Derbyshire hards	33 2	24 0
Seconds	32 2	23 0
Cobbles	32 2	23 0
Nuts	32 2	22 0
Washed smalls	30 2	17 0
Best hard slacks	28 11	17 6
Seconds	28 5	17 0
Soft nutty	28 2	17 0
Pea	26 8	11 6
Small	24 2	9 0
House, branch	39 0	37 2
House, best Silkstone	37 6	33 8
Blast-furnace coke	65 9	22 6

Export. SCOTLAND.

Lanarkshire ell	76 0	25 6
Lanarkshire splint	80 0	25 0
Ayrshire steam	73 0	24 0
Ayrshire splint	76 0	26 0
Fifeshire steam	80 0	20 0
Fifeshire screened navigation	80 0	28 0
Lothians, best steam	75 0	23 6
Lothians, secondary steam	73 0	23 0

Export. NORTH COUNTRY.

Best Blyth screened steam	70 0	23 0
Best Blyth smalls	50 0	11 0
Best Tyne screened steam	70 0	22 6
Best Tyne smalls	50 0	12 0
Northumberland unscreened	65 0	18 0
Best Durham screened steam	70 0	23 0
Wear special gas	70 0	23 0
Tyne prime gas	70 0	23 0
Tyne second gas	60 0	20 0
Prime Durham bunkers	60 0	21 6
Second-class Durham bunkers	52 6	20 0
Coking unscreened and smalls	60 0	20 0
Foundry coke, beehive	85 0	35 0
Foundry coke, patent oven	80 0	30 0
Gas coke	70 0	21 6

FERRO ALLOYS.

	Highest.	Lowest.
Tungsten powder (lb.)	3s. 1d.	1s. 8d.
Ferro tungsten (lb.)	2s. 5d.	1s. 6d.
Ferro chrome, 4 to 6 p.c. carbon (ton)	£38	£28
Ferro chrome, 6 to 8 p.c. carbon (ton)	£37	£26
Ferro chrome, 8 to 10 p.c. carbon (ton)	£37	£26
Ferro chrome, specially refined—		
Max. 2 p.c. carbon	£89	£79
Max. 1 p.c. carbon	£105	£94
Max. 0.75 p.c carbon	£120	£110
Max. carbon free (lb.)	3s.	2s. 8d.
Metallic chromium (lb.)	7s. 6d.	5s. 6d.
Ferro manganese (ton)	£32	£18
Ferro silicon, 45 to 50 p.c.	£20	£12 10s.
Ferro silicon, 75 p.c.	£28	£20
Ferro vanadium (lb.)	35s.	21s.
Ferro molybdenum (lb.)	9s.	8s.
Nickel (ton)	£215	£190
Cobalt (lb.)	20s.	14s. 6d.
Aluminium (ton)	£165	£110

THE MIDLANDS.

The opening of 1921 found electrical engineers in the Birmingham district with a considerable quantity of work in hand, large generators and power units figuring prominently and relating in many cases to industrial developments in this country. Another feature was activity in the production of handy electrical generating sets for medium-sized dwelling-houses; but while ironfoundries generally continued to be well employed, the decline in the motor trade was already causing a serious displacement of business, with the result that some of the new big foundries, designed specially for the service of that trade, were practically at a standstill, and aluminium foundries were particularly badly hit. What troubled ironmakers rather much, however, before January had run its course, was the manner in which Belgian pig iron was penetrating the home market. Meanwhile, unemployment was rapidly rising throughout the whole of the Midland area, one of the industries to feel the stress of the situation most severely being the chain-cable and anchor trade, of which the Cradley district of East Worcestershire is the centre. In other departments of industry, however, matters were almost equally as bad, and, in order to raise much required cash resources, not a few big engineering firms were putting on the market stocks of raw material bought against orders which had been suspended or cancelled.

With February the industrial gloom only deepened. There were no new iron and steel orders, and business was almost at zero, the only effect of price concessions having been to cause buyers to hold right off the market, except for bare immediate necessities. In the Black Country blast-furnaces were being put out and plants being devoted to the production of foundry material laid off. Several important steel works were about this time preparing to suspend operations, but, as showing the general uncertainty of the position, others that had been closed down were arranging to resume work. Few people knew exactly where they stood, but what was regarded as a rather good sign was the fact that Belgian iron and steel prices were rising. In the midst of all this it seemed more than passing strange to discover that the difficulties of Birmingham manufacturers were being added to by a serious under-supply of electric power for productive purposes, for which the Corporation was chiefly responsible, there being on the books of that authority, at the time referred to, applicants for 45,000 horse-power of current which could not be given.

In the third month not the slightest improvement in the industrial outlook was discernible, in spite of reassuring speeches which some of the leaders had delivered to the effect that the spring would witness a change for the better. On 'Change, reports brought in from the districts were all of the same import—additions to the long list of standing mills and forges—and manufacturers began to give very close attention to the problem of production costs, realising, as they did, that no headway against foreign competition could be made until a solution had been found. On the other hand, there appeared to be a slight improvement in the malleable iron trade of South Staffordshire, and an impression seemed to be gaining ground that in the finished iron industry generally the worst of the depression had been seen.

The Financial Position.

But then, of course, one of the characteristics of the year was the number of hopeful prophecies and the few occasions on which they were realised. It was so in the case in point, for at the first "Quarterly" on the Birmingham Exchange in April it was stated that Staffordshire ironmasters were "high and dry," whilst the Birmingham market was in the possession of the foreigner. One bright gleam there was, however, in the "merrie month," when it was announced that, as an act of faith, two firms—John Bradley and Co., of Stourbridge, and John Bagnall and Sons, of Wednesbury—were carrying out extensions, the former by bringing the forge up to date by the addition of Siemens gas furnaces, and the latter, who already had Siemens furnaces, by extending the forge. The general position at Whitsuntide was that only by securing raw material from cheap foreign sources were many Midland manufacturers able to carry on at all, for whatever rise had taken place in continental iron and steel, and whatever "cuts" had been made at home, neither the one nor the other had so far been sufficient to bring the home and foreign prices within competitive distance of each other. The financial position was serious, besides which the damage to furnaces through cooling down could not be ascertained in most cases until an attempt was made to put them in blast again. This was the second month of the national coal strike. Industry everywhere was paralysed, but the shortage of foundry pig iron, arising out of so many furnaces being out of commission, led to advances in the price of that material. Rather more activity was observable about this time in the demand for wire, largely on account of our oversea possessions.

June dawned and still no settlement of the colliery trouble. On the contrary, another industrial difficulty had arisen—differences between employers and employed in the engineering trades which at times assumed very serious proportions, though in the end, after a long period of negotiation, a settlement was

reached on the question of the deflation of war bonuses. With the end of the month came peace at the collieries, but up to the close of July, at least, ironmakers were complaining bitterly that at its then price coke was much too dear to make iron production a profitable proposition. By the following month, however—the Bank rate having meantime been lowered—the tone throughout the iron and engineering districts of the Midlands seemed a shade more hopeful, for blast and steel furnaces were beginning to resume operations, though the trouble still was the too high cost of fuel. But that a distinctly brighter view was beginning to be taken may be gathered from the decision of the Wolverhampton Corporation to spend over £120,000 in an extension of its generating plant, so as to be able to meet the increased demand for current for power purposes. At the same time a fall announced in coke prices was declared by the ironmasters to be altogether inadequate, and the rolling mills and forges which had reopened did not appear to be well supported.

Tackling Foreign Competition.

September saw arrangements in hand for putting into blast several iron furnaces, though the motive was, in some cases, more humanitarian than utilitarian; but the best that could be said for constructional engineers was that they were poorly employed. The opinion seemed to be that another six months would pass before any appreciable improvement occurred. The most important movement, perhaps, was that made by iron and steel producers to tackle very seriously the question of foreign competition, for from that point onwards the home prices gradually approximated to those of the Continent, which were advancing, until finally there was little or no excuse for home consumers to buy their raw material abroad. It was this factor, apparently, that infused a little more hope into the engineering trade of the Coventry district, while an early revival of the finished bar industry of the Midlands was being talked of. A feature of interest in September was the announcement that John Freakley and Co., of Dudley Port, had acquired a lease of the old slag tips at Acrefair, Denbighshire, with the intention of working them for the tar-macadam process. The tips were the only visible sign of the old British ironworks closed down some years ago. A matter that began to assume serious proportions about this time was the urgent need of a revision downwards of railway rates, not only for metals but for minerals, for in the North Midlands particularly the coal export trade was being all but strangled by the high cost of haulage.

Late in October it was reported that Braithwaite and Sons, of West Bromwich, had secured a contract from the Bombay Corporation for the installation of a big water main requiring 105 miles of iron piping, the total cost of the scheme, it was said, being one and a-half millions sterling, and by the next month manufacturers generally were speaking more hopefully of the outlook. Some good contracts were said to be in sight, though there was no tendency to raise expectations too high. This precaution was well justified, as events proved, for much of the hopeful spirit was due to the prospect of naval contracts for the building and equipment of four capital ships—a prospect that faded right away a little later as a result of the Washington Conference. There was, however, a notable improvement in the galvanised sheet industry, but general engineering in the Midlands was extremely quiet, the nut and bolt industry being stagnant, with the Black Country works averaging not more than two days a week. From that, nevertheless, there was a measure of recovery, and the export branch of the brass trade brightened up quite encouragingly, Australia and New Zealand particularly coming into the market as buyers of water fittings. It was in November, too, that the announcement came to the effect that John Thompsons, of Ettingshall, near Wolverhampton, had secured a contract worth £280,000 for the supply of water-tube boilers for the Morwell power scheme of the Electricity Commissioners of Victoria.

Guest Keen's Developments.

Several interesting facts were mentioned at the meeting in Birmingham in September of shareholders in Guest, Keen and Co. The chairman, Mr. Edward Steer, said the most important event that had occurred during the company's year was the acquisition of a controlling interest in the important coal distribution business of L. Guéret and Co., Limited, of Cardiff—one of the largest shippers of coal in South Wales and the selling agents, solely or jointly, for some of the most important collieries in that district. In addition, they held a very large interest in the Société Générale de Houilles and Agglomérés, one of the largest patent fuel-making and coal distributing companies in France, and a similarly large interest in La Societa Britannico-Italiana Guéret, having depôts at Genoa and Naples. They were, besides, largely interested in a number of other important coal and patent fuel companies, having works or depôts in France, Algeria, Tunisia, Morocco, the Islands, the Argentine, Brazil and elsewhere. Another important matter was the acquisition of a considerable proportion of the preference shares in John Lysaght, Limited, in which the company now held over 99 per cent. of the 2,000,000 ordinary shares. The company had also obtained a large interest in the Crown Preserved Coal Company, and had increased its holding in the firm of Previllier, Urban and Co., of Vienna, which makes screws, bolts and nuts on a large scale.

Toward the close of the year it could not be said that the stagnation in the industrial life of the Black Country showed much sign of improvement, nor had the reductions in the quotations of Staffordshire marked and unmarked bars had any noticeable effect in inducing new business, but makers of foundry iron were hoping for better things as the result of the many orders said to have been placed at the Olympia motor shows, and steel orders were being very keenly competed for. In the Coventry district the tide of unemployment seemed to be receding a little. The outlook for engineering was rather encouraging, railway orders being placed a little more freely, and there being more structural contracts about. The galvanised sheet trade continued fairly busy.

LANCASHIRE.

One of the best reports in the early days of the year was that an order had been placed by the Lonely Mine Company, of Rhodesia, with Crossley Brothers, of Manchester, for what was believed to be the largest gas power installation ordered from South Africa for some years. The plant was to include four Crossley waste wood suction gas plants, with a total output of 1400 brake horse-power, and four horizontal multi-cylinder gas engines, as made by the Premier Gas Engine Company (Crossley Brothers), of Sandiacre, near Nottingham. On the North-West Coast quietness was the rule in the steel, engineering and shipbuilding industries, though at Workington there was still fair activity in the rolling of rails and small sections, while at Barrow a certain amount of work was proceeding in fitting-out the Scythia and two other Cunarders, most of it, however, being held up by the joiners' strike. The position of the hematite pig iron trade was very bad, all the furnaces at Barrow being out of operation, while the Millom and the Ulverston ironworks had had to close down, and the rate of production in Cumberland was cut down to the lowest possible. This led to a complete stoppage of the North Lancashire ore mines. Vickers' contract with the Donaldson Line for the building of a steamer was stated to have been cancelled. In the Manchester district engineering prospects were growing steadily worse. Apart from textile machine makers, locomotive builders and the heavier branches of the electrical power plant industry, all sections of engineering production were gradually coming to an end of their orders, cancellations being frequent and the amount of new business coming forward negligible. At the close of the month the Barrow hoop works were stated to be fairly occupied, with some good orders in hand for hoop, strip, &c.

By February there were only ten furnaces in blast in the whole of the North-West iron district, and the Hodbarrow ore mines at Millom, the richest hematite ore mines in the world, had to close down for a short time, but a little later the demand for hematite iron blazed up fitfully through the filling by the Barrow Steel Company of a rather urgent order. Work on the Scythia, as well as on the Cross-channel boat Biarritz, continued to be seriously retarded by the joiners, and eventually the Cunard liner had to be completed in France; but the airship-building department at Barrow was in the meantime making the best of things. The Vickers-built R 80, which had passed its speed trials and had been taken over by the Air Ministry, was by mid-February waiting to leave Barrow for one of the Government air stations, and Vickers pushed on with an airship of the "Scout" class building for the Japanese Government.

In March Vickers launched from their Barrow yard the Cunarder Antonia, the first of a series of six passenger steamers which the Cunard Company was having built in this country, and about that time the Charcoal Iron Company, of Backbarrow, near Ulverston, blew in its furnace after having carried out repairs and alterations to the plant. April saw another Vickers' launch, this time the motor-driven Scottish Standard, the first of four oil ships built at Barrow for Tankers, Limited. The vessel was fitted with Vickers' internal combustion engines and had a carrying capacity of 10,000 tons. This launch was followed very quickly by that of the Moreton Bay, which was the first of three vessels being built at Barrow for the Commonwealth Line. An interesting event early in May was the ceremony of starting up an important addition which the Salford Corporation had made to its electrical plant, in the shape of a 5000-kilowatt turbo-alternator, supplied by the Metropolitan-Vickers Electrical Company, and another was the fact that important extensions were being carried out by the Lancashire Dynamo and Motor Company at Trafford Park, comprising two large bays and a canteen to seat 500 employees.

The Royal Visit to Manchester.

Arising out of the Royal visit to Manchester in July, a party of visitors to the works of the Metropolitan-Vickers concern had a good insight into some of the principal contracts the company had in hand at the time, and as they help to reflect the actual trade situation it may be as well to refer briefly to them here. They included a 25,000-kilowatt turbo-alternator for the Manchester Corporation's new Barton power station, and one of 20,000 kilowatts for Shanghai, a large number of ship-lighting turbo-generators, each of 375 kilowatts, for the Cunard Line, large stators for 1200 horse-power alternating-current motors being built for Italy, and a rolling mill shaft for transmitting 8000 horse-power. The second of the oil tankers built at Barrow was launched in July, being named the Scottish Maiden. The vessel was 425ft. in length, had a carrying capacity of over 10,000 tons, and will be fitted with Vickers' solid injection internal combustion engines. On the whole, however, shipbuilding and engineering prospects on the North-West Coast remained very gloomy, but so far as hematite iron was concerned August yielded the first sign for a very long time of renewed industrial activity. It was announced that one of the furnaces at Cleator Moor, owned by the Whitehaven Iron Company, had been put into operation, after having been standing idle for months, and the United Steel Companies, Ltd., lighted up a furnace at Workington.

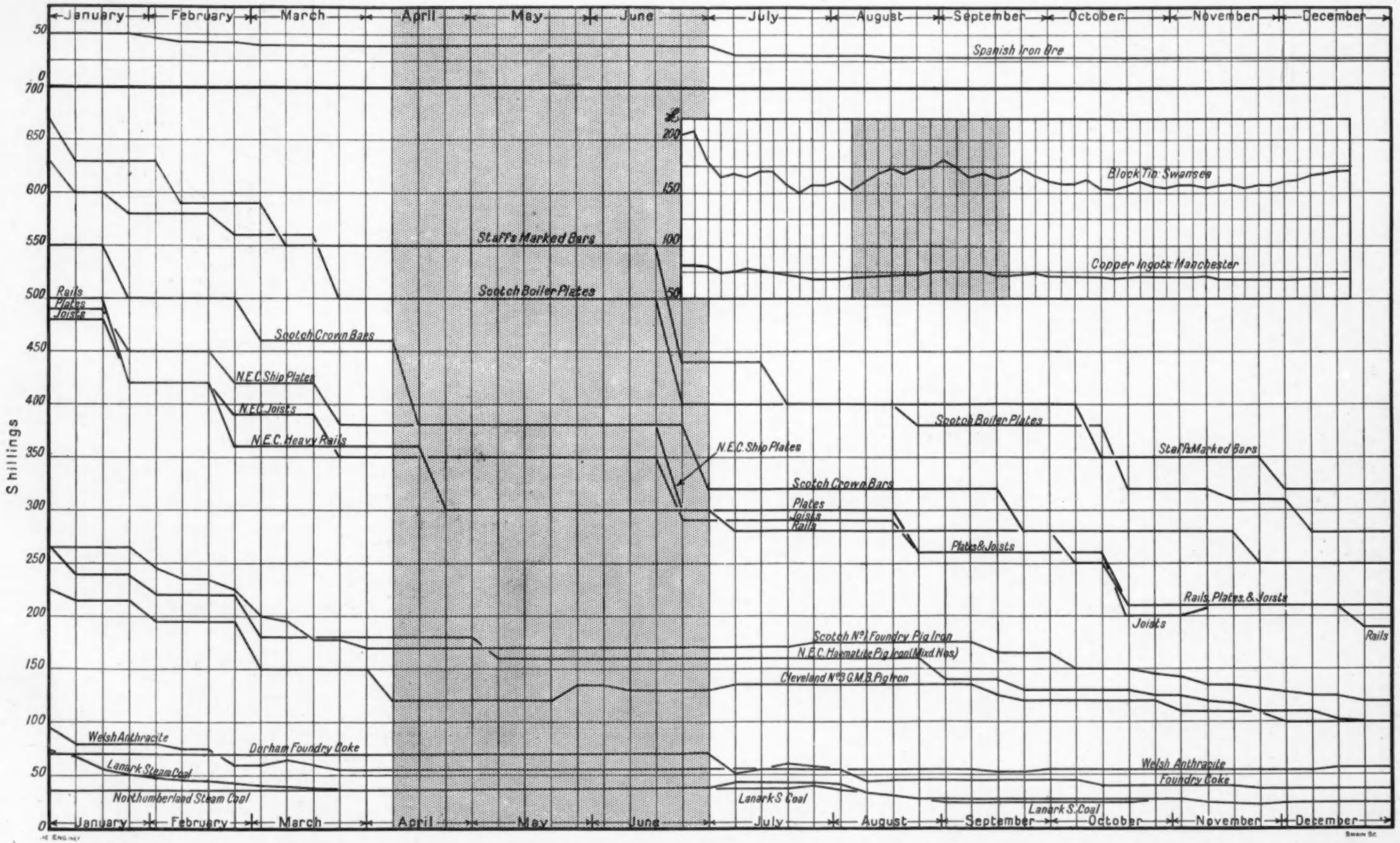
Without any increase in actual business, there appeared to be, in September, a more hopeful feeling in the engineering districts of Lancashire, shared chiefly by those who believed an enormous amount of business was being held up until an appreciable fall in the cost of production had occurred, and among municipal schemes involving considerable expenditure was one somewhat on the lines of the Liverpool and North Wales electricity scheme, which had been under consideration from the beginning of the year. The latest plan, which was discussed at a conference of local authorities at Preston in September, concerns the towns of Blackburn, Preston, Accrington, Bacup, Colne, Darwen, Haslingden, Nelson, Rawtenstall, Fleetwood, Lytham and St. Annes, the proposal being to serve the whole of that "district" by means of three large generating stations to cost several millions sterling. The discussion, however, stood adjourned indefinitely. By the close of the month there were small, but quite distinct, signs of improvement in the hematite iron industry, which, in a measure, reflected themselves on the North-West Coast industries generally, though buyers of steel were still holding off for lower prices. The joiners' long strike having been settled, that section of the shipyard industry was running full time, but much work had definitely been lost to foreign rivals.

Outlook Seemed to be Clearing.

No sooner had October dawned than Vickers put the second of the Commonwealth Line's new boats—the Hudson Bay—into the water at Barrow, the third vessel—the Jervis Bay—being then on the stocks; and this launch was followed shortly afterwards by that of the Slieve Donard, a cattle boat for the North-Western's Holyhead-Dublin service. In the meantime the steel trade at Workington was looking a little more brisk, and the rolling mills at Barrow had been re-started after being idle since the spring. The Siemens department and foundries were at that time fairly well employed, and the hoop mills were busy. In Manchester engineering districts, too, the outlook seemed to be clearing, one steel works—the plant of the Wigan Coal and Iron Company—having resumed operations after being idle for nearly a year. Another good feature of the position at about that period was the formal opening of the extensions to the Richmond Gas Stove Works on the Ship Canal at Grappenhall. The original scheme was commenced in 1906, the buildings now covering 20 acres. The prospects for this class of engineering seem decidedly good. In mid-November Vickers launched the third of the oil tankers, viz., the Scottish Minstrel, its capacity and equipment being similar to its two predecessors. The decision of the Manchester Corporation to construct the new water-pipe from Thirlmere of steel instead of the usual cast iron piping was the subject of a good deal of discussion amongst the interests concerned. The proposal is to build up the tube from steel sheets, welded by the oxy-acetylene process, the sheets required being estimated at 17,000 tons.

As the end of the year approached many engineers in the various Lancashire districts were taking a rather brighter view of the outlook, though there was very little really to awake enthusiasm, and on the North-West Coast the rail mills, to some extent, were being kept busy on Indian orders. One good point was that the firm of Walker Bros. (Wigan), Limited, secured the contract for the new ventilating plant for the Severn Tunnel, the capacity being 800,000 cubic feet of air per minute, and the plant including Lancashire boilers with a working steam pressure of 150 lb. per square inch, and a scheme was being discussed for the construction of a new trunk road between Manchester and Liverpool at an estimated cost of £4,000,000. The proposal of the Salford Electricity Committee to erect a new power station at Agecroft, at an estimated cost of £847,000, has been approved by the Salford Corporation, and, as an example of the manner in which the price of building materials is being deflated, it may be mentioned that an estimate of the work a year ago figured at £1,189,000. Regarding shipbuilding, the operations during the year at Vickers' naval construction works at Barrow included the launch of 64,320 tons of shipping and the construction of 46,350 horse-power of machinery, the latter embracing work for the London County Council and the Compania Transatlantica.

FLUCTUATIONS IN THE PRICES OF ENGINEERING MATERIALS DURING THE YEAR 1921



The shaded portions of the above diagram indicate the duration of the coal strike. The prices are all given in shillings, except for tin and copper, for which the unit is the pound. It should be noted that a separate zero is given for iron ore. The horizontal divisions are weeks, taken from Friday, January 7th, to Friday, December 30th. In the case of coals the prices are those quoted for export, as it is practically impossible to give market prices for industrial consumption at home. Thus in South Wales the prices for inland consumption are sometimes 2s. per ton above, and at other times as much below, export prices. In Scotland the pithead price is generally some 2s. below the f.o.b. price, but carriage costs from 4s. to 7s. 6d. according to the distance. In the Midlands home prices are generally from 2s. 6d. to 4s. per ton less than those for export, for such classes as are exported.

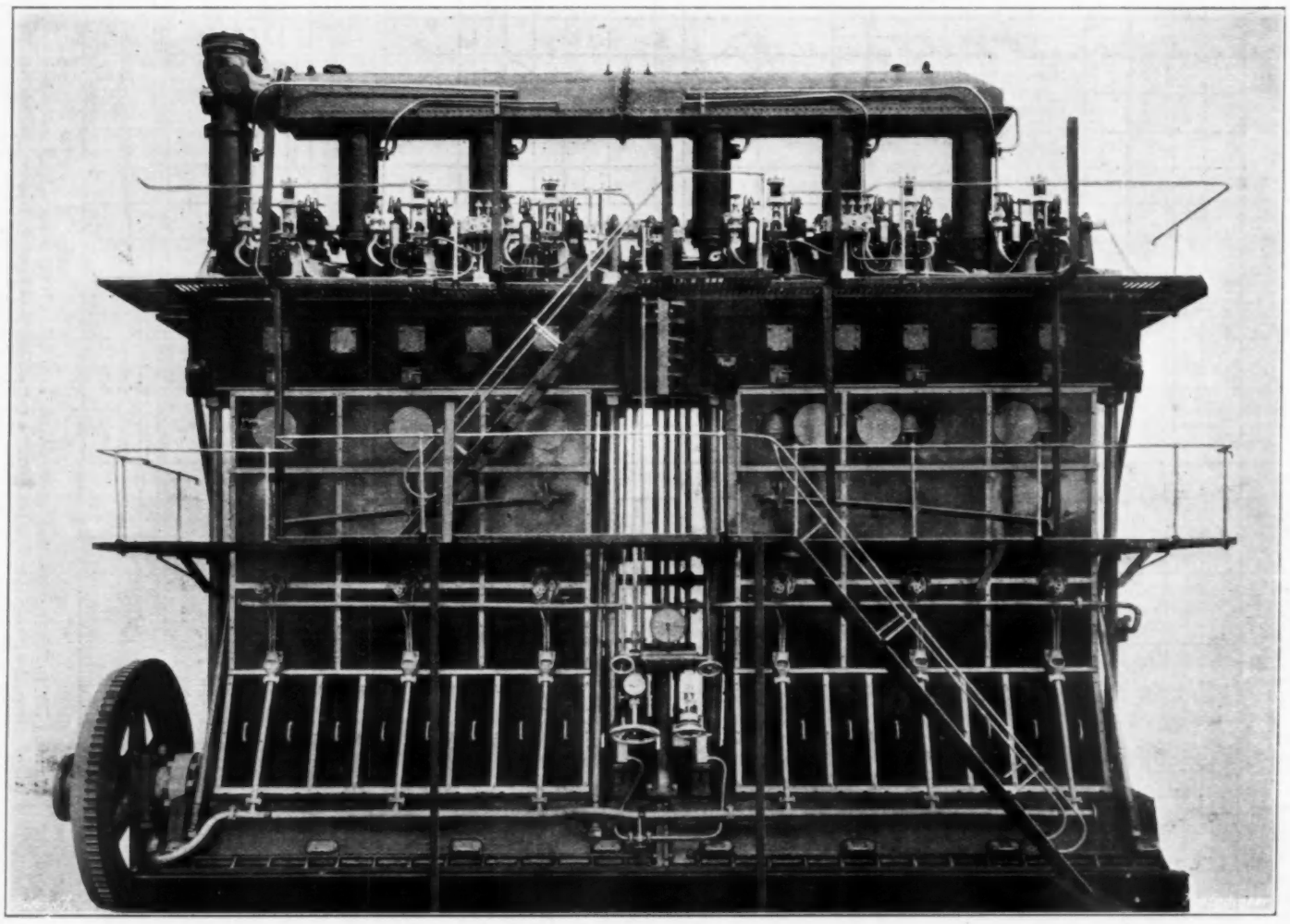
Motor Ships in 1921.

At Home.

IN a year of extreme depression and uncertainty in the shipbuilding industry, in which so few new contracts were placed, and so large a proportion of the existing tonnage was laid idle, it is more than satisfactory to note activity in motor ship construction, accompanied as it was with marked progress. In no other country has there been produced during the year such a number of different representative types of engine. This, as we have often pointed out, cannot fail to eliminate weak points in construction and practice, and cause the evolution of engines more perfectly adapted to meet marine conditions. One of the most striking features of the work of the societies and institutions was the large amount of interest shown in the Diesel oil engine, and the problems which are intimately connected with its development. Interest proved so strong at the Institution of Engineers and Shipbuilders in Scotland that a special series of informal meetings was arranged to amplify discussion, whilst at the North-East Coast Institution of Engineers and Shipbuilders a special Diesel Engine Study Circle has been arranged. These facts augur well for the future of the motor ship at home, as any permanent success must be based on sound technical knowledge. In this connection it may be noted that some modifications are to be made in the Board of Trade Regulations with regard to motor ship engineers, and the date for the endorsement of present tickets is to be extended until January 1st, 1924; this will give ample opportunity for the many engineers now in training to qualify before that date. Two of the most significant features of 1921 development were the advent of the single screw motor vessel and the motor passenger liner, indicating the growing confidence in the reliability of the Diesel motor. As we have been reminded by Lord Pirrie, the line of progress must be gradual and sure, and the conversion of a tested and tried motor vessel such as the Glenapp to the large passenger liner Aba, is sound practice. Messrs. Harland and Wolff have recently completed the reconditioning of the vessel, which is now provided with full equipment and accommodation for 360 passengers, and which, under the direction of Messrs. Elder Dempster and Co., has been placed on the West African run. During the past twelve months a large number of motor ships were completed at the Belfast and Clyde establishments of Messrs. Harland and Wolff, and among others we have pleasure in illustrating in our Supplement one of the Bibby Line ships, Dorsetshire, and of giving a view of the complete main and auxiliary machinery for the Glenogle. Similar machinery is under construction for the Lochkatrine, a 14,000-ton motor ship just completed by John Brown and Co., Limited, at Clydebank for the Royal Mail Steam Packet Company. Brief mention may also be made of the sister ships Lobos, and Losada, built for the South American trade of the Pacific Steam Navigation Company. These are vessels carrying about 10,000 tons of cargo, with engines of the Harland and Wolff four-cycle type, each developing 1600 indicated horse-power at 115 revolutions per minute.

Another motor passenger liner recently placed in commission, a photograph of which we reproduce in the Supplement, is the Domala, which was built for the British India Steam Navigation Company, by Messrs. Barclay, Curle and Co., and engined by the North British Diesel Engine Works, Whiteinch, Glasgow. On the recent trials a speed of 13¾ knots was attained, the engines developing 5200 indicated horse-power. A noticeable feature of the trials was the smooth running of the engines. Other machinery is approaching completion at Whiteinch, for the Hauraki, recently launched by Messrs. Denny at Dumbarton for the Union Steamship Company of New Zealand, and for the British India Steam Navigation Company's cargo and passenger motor ship Dumra, which has just been completed by Messrs. Charles Hill and Sons of Bristol. A complete description of the North British engine will be found in our issue of July 29th.

An important contribution to the motor ships of the year is found in the series of motor tankers built by Vickers, Limited, and fitted with engines of the Vickers' solid injection type, details of which we gave on July 15th. Early in the year the Seminole, a sister ship to the Narragansett, was added to the Anglo-American Oil Company's fleet and more recently the Scottish Standard and Scottish Maiden, motor tankers of 10,000 tons deadweight capacity, have run successful trials and have been handed over to their owners, Tankers, Limited. We give in our Supplement an illustration of one of the engines installed in these ships. As evidence of the success of the solid injection principle we may refer to the Yngaren—see Supplement—built and engined by William Doxford and Sons, Limited, at Sunderland, for the Transatlantic Steamship Company, Limited, of Gothenburg. Since the description of the Doxford opposed piston engine, which appeared in our number of June 17th, shortly following the sea trials of the Yngaren, this vessel has seen extensive service in Baltic and Eastern waters, and a perusal of the navigation and engineers' logs shows a remarkable reliability and flexibility as regards the use of heavy fuel oils. Other notable vessels which have left Tyne yards during the year are the Armstrong-Sulzer engined tanker, Conde de Churruca—see Supplement—which we described on September 16th, and the more recent North-Eastern Marine Werkspoor engined ship, Sevilla, for the Otto Thoresen Line of Christiania. This vessel is specially equipped for the fruit carrying trade. The 1400 indicated horse-power North-Eastern Werkspoor engine, which is illustrated herewith, is the first engine completed by the North-Eastern Marine Engineering Company, and although approximating closely to the standard Werkspoor design new features are embodied. Two of these may be referred to, namely, the device interlocking the handle operating the telegraph, with the starting mechanism control, and the Hawkes-Hunter comparative pressure indicator, which enables the engineer on duty to record the pressure in any cylinder. Swan, Hunter and Wigham Richardson, Limited, have under construction at their Neptune Works engines of the two-cycle port-scavanging type, which embody new features of design. Another fruit carrying vessel, the trials of which have only shortly been completed, is the Pinzon, built and engined by Beardmore and Co., Limited, Dalmuir, for Messrs. McAndrews. The Pinzon is a single-screw vessel of 2000 tons deadweight capacity, engined with a 1250 brake horse-power 125 revolutions per minute six-cylinder Beardmore-Tosi engine, of the shop trials of which we gave an account on November 11th. The Tosi special valve gear certainly marks an advance in four-cycle construction. The Cammellaird-Fullagar engine has always commanded attention as being the work of an able British engineer, and an important event of the year was the completion of the Malia—see Supplement—built by Messrs. William Hamilton and Co., of Port-Glasgow, for the Calcutta service of the Anchor Brocklebank Line. The machinery of the Malia consists of two 500 brake horse-power Cammellaird-Fullagar engines, one of which did nearly 10,000 miles of sea service before being removed from the Fullagar and installed in the Malia. A brief account of the trials of the Malia was given in our issue of October 7th, and it is satisfactory to report that larger sizes of engine are under construction at Birkenhead and also at the works of David Rowan and Co., Limited, Glasgow, and of John Brown and Co., Ltd., Clydebank. At Messrs. Denny and Co.'s Dumbarton yards and at the Linthouse yards of Alexander Stephens and Sons, Limited, Sulzer type engines are approaching completion and will be finished early in the New Year. Extensive tests



1400-I.H.P. WERKSPOOR TYPE ENGINE—THE NORTH-EASTERN MARINE ENGINEERING COMPANY, LIMITED

made with the experimental "Still" engine at Messrs. Scotts, Greenock, have yielded valuable data regarding the economies possible, and the range of fuels which may be used with this type of engine. Messrs. Scotts are now prepared to install "Still" engines of large power.

Space prevents us from dealing in any detailed manner with the smaller oil-engined craft which have been built by such firms of repute as John I. Thornycroft and Co., Ltd.; William Beardmore and Co., Ltd.; Messrs. Plenty; James Pollock, Sons and Co., Ltd.; the Bergius Launch and Engine Company, and Vickers-Petters, Ltd.; all of whom have contributed excellent examples of the application of the motor engine to marine propulsion. Since we described the

THE MOTOR SHIP MALAYA—BURMEISTER AND WAIN

Vickers-Petters engine on February 25th, several improvements relating to manœuvring and reversing with compressed air, to electric starting by means of a special electrically-heated plug, and to more efficient and economical lubrication by a patented spray lubricator have been effected. At the time of writing technical details have reached us with regard to the Kelvin sleeve valve engine, constructed under the Burt, McCollum patents, by the Bergius Launch and Engine Company. This engine is of quite new design in connection with motor boat work.

America.

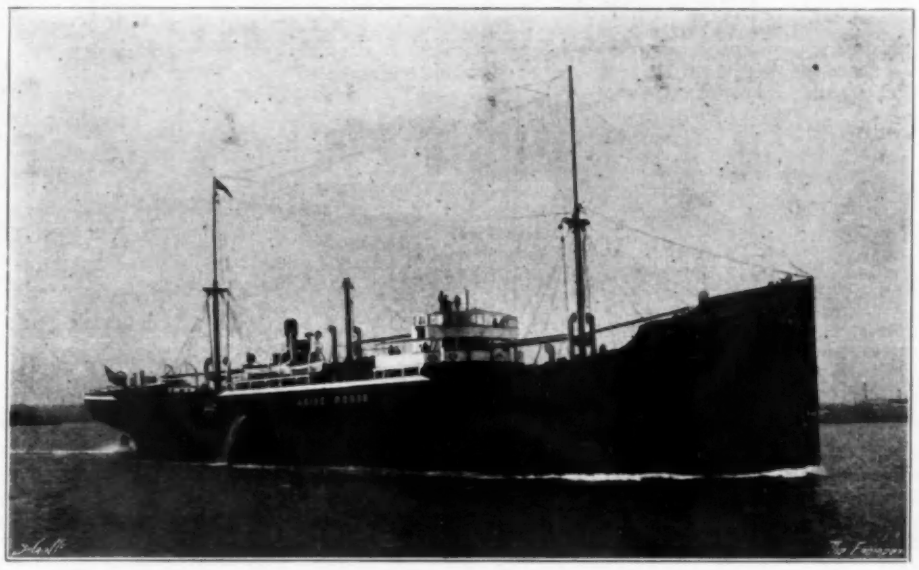
The past year was one of considerable activity as regards motor ship progress in both the Atlantic and Pacific shipbuilding yards. American shipping concerns are now taking definite interest in the construction of a motor ship fleet, which interest has without doubt been stimulated by the large number of motor ships, chiefly of Scandinavian origin, which are trading with American ports, and familiarise owners with operating costs and results. Many of the large American firms are building under license from the leading European Diesel engine makers while others have developed their own types of engine. As an example of the former class we may mention the United States Shipping Board's first motor ship, William Penn, which was launched from the Philadelphia yard of William Cramp and Sons Ship and Engine Building Company, and ran her loaded trials early in September. Built on the Isherwood system the William Penn has a deadweight capacity of 12,375 tons and is equipped with twin-screw Burmeister and Wain machinery, the engines being of the six-cylinder type, developing together a shaft horse-power of 4500 at a speed of 115 revolutions per minute, the cylinder bore and stroke being 740 mm. and 1150 mm. respectively. Trading on the Far Eastern route, the vessel has made several successful voyages. At the Cramp Company's yards, four 2250 indicated horse-power Burmeister and Wain type engines are nearing completion for the American Hawaiian Company's new motor ships Californian and Missourian, the first of which was launched during November.

One of the notable Pacific coast vessels of the year is the motor ship Kennecott, built by the Todd Dry Dock and Construction Corporation, at Tacoma, Washington, for the Alaska Steamship Company. In this vessel MacIntosh and Seymour engines are installed, the two engines being of the six-cylinder type with a cylinder bore of 21in. and a stroke of 32in. developing a 2400 indicated horse-power at 140 revolutions per minute. This vessel, which is used on coastwise traffic, has shown good results on boiler oil, special pre-heating systems being adopted so that heavy Californian oils may be utilised. Another motor ship recently built by the Moore Shipbuilding Company, of Oakland, California, and engined with Werkspoor type machinery by the Pacific Diesel Engine Company, also of Oakland, is the Standard Oil Company's motor tanker H. F. Harper. The Pacific Diesel Engine Company has, with the consent of the Werkspoor Company, introduced several new features into its design of engine, chief among them being a modified form of engine framing and the position of the compressor, which is placed forward, instead of being driven by rocking levers from the crossheads as in the original Werkspoor design.

As this motor tanker is almost a duplicate of the steam driven tanker El Segundo, also belonging to the Standard Oil Company, interesting comparative results may be expected.

Denmark.

The courage and foresight of Danish engine builders and shipowners during the early days of motor ship development has been well rewarded by the period of prosperity which has followed the successful adoption of the Burmeister and Wain four-cycle type of Marine Diesel engine. The Burmeister and Wain factories and yards in Copenhagen have been fully occupied during the year. New slipways have been laid down, and a large new foundry is approaching completion. Among other interesting vessels completed in 1921 was the large motor ship Malaya, which is illustrated herewith, and which is sister ship to the Africa, constructed the previous year for the East Asiatic Company. These ships have a deadweight capacity of 13,500 tons, and are equipped with twin screw standard engines developing 4500 indicated horse-power and giving a speed of 12 knots. All deck machinery is electrically driven.



THE SINGLE-SCREW MOTOR SHIP LEISE MAERSK—BURMEISTER AND WAIN

One of the chief developments of the year was the introduction of a special design of long-stroke slow-speed engine for single-screw vessels; this type of engine can be conveniently used for the conversion of steamers to Diesel engined vessels. Our remaining illustrations show the Leise Maersk and its engine, which develops 1500 indicated horse-power at 85 revolutions per minute, with cylinders 630 mm. diameter by 1300 mm. stroke. It will be noted that the ratio of bore to stroke is approximately 1 : 2 giving the correct piston speed with an engine speed of 80 to 85 revolutions per minute. The cylinders are constructed in units of three, arranged on A-shaped frames, the whole construction being as light as possible consistent with strength. The builders strongly recommend this type of engine for vessels of a deadweight capacity of 3000–5000 tons. At the Holeby Diesel Engine Works at Holeby, Copenhagen, a number of smaller engines varying in power from 120 brake horse-power to 800 brake horse-power has been constructed.

Norway.

The largest ship ever built in Norway has recently been completed at the Rosenberg Mekaniska Werksted, Stavanger, and is shortly expected to call at an English port on her maiden voyage to America. The Handicap is a vessel of 9000 tons deadweight capacity, and is of special interest on account of the propelling machinery which is of the Sulzer two-cycle type, this being the first installation to be fitted with independent turbo blowers instead of scavenging pumps driven from the main engines. The engines are similar in construction to those described and illustrated in our article of September 16th on the Armstrong-Sulzer engine with the exception of the scavenging arrangements above mentioned. With turbo-blowers each engine develops 1500 brake horse-power at a speed of 110 revolutions per minute. The auxiliary electrical plant is correspondingly larger and consists of two 300 brake horse-power two-cycle engines driving generators. Similar installations are under construction at the works of Alex. Stephens and Sons, Limited, Linthouse, Glasgow, and much interest attaches to the performance of the Handicap.

Sweden.

The year that has passed was full of activity as regards motor ship construction. The Götaverken yards at Gothenburg have completed a large number of vessels engined with the Burmeister and Wain type of engine, for which the Götaverken hold the Swedish licence. Two vessels recently delivered are fitted with the special long stroke engines designed for single-screw vessels. A ship of outstanding interest is the ore carrier Strässa, which is the first of a probable fleet of 16 ships to be built for the Swedish Ore Company, Grangesberg, Oxelösand. The engines comprise two of the Götaverken Burmeister and Wain 2600 indicated horse-power type, and the gain in space obtained by the shorter engine-room allows of a much more even loading and stressing of the hull owing to the provision of five holds instead of four if steam machinery were used, and allowing the largest ore heap to be 1850 tons as against 3000 tons in the steamer. Interesting comparative figures were given by Mr. T. Palmqvist in a paper before the Society of Naval Architects in Sweden regarding the actual stresses in Diesel and steam-propelled ore-carrying ships. Technical particulars have recently been published of the Nobel Diesel engine built by the Nobel Diesel Company at Nynashamn. The 2000 indicated horse-power model is of the two-cycle four-cylinder type, having cylinders 675 mm. diameter by 920 mm. stroke, and developing full power at a low speed of 105 revolutions per minute. The engine framing is made in cast iron of box section. Double acting scavenging pumps are driven by rocking levers from the main crossheads. Valve scavenging is retained, but special arrangements are made for supercharging. The engine design is characterised by a pleasing symmetry and robust construction. Several ships were engined by the Atlas Diesel Engine Company during the year.

Holland.

In the early days of the motor ship we had the pleasure of describing in our pages the Vulcanus, one

of the pioneer motor vessels of the world. The lead then established by the famous Werkspoor firm of Amsterdam has been fully maintained during the past year, and several ships have been built for Scandinavian owners. One of the most recent of these is the motor ship Geisha, constructed by the Netherland Shipbuilding Company, for Messrs. Winge and Co., Christiania. The Geisha is a cargo vessel of 7000 tons deadweight capacity, having two standard Werkspoor engines developing 1400 indicated horse-power in six cylinders at a speed of 125 revolutions per minute. The cylinders have a diameter of 560 mm. and a stroke of 1000 mm. One of the main features of the new valve gear design is the simple motion by which the cam levers are moved askew so that the rollers are transferred from the ahead to the astern cams, which are situated side by side on the cam shaft. A full description of the Werkspoor engine was given in our issue of August 10th. Dutch shipping concerns are keenly alive to the importance of the motor ship, and one of the latest ships delivered by Messrs. Burmeister and Wain, of Copenhagen, is the Kedoe, for the Rotterdamsche Lloyds Company. This vessel

Switzerland.

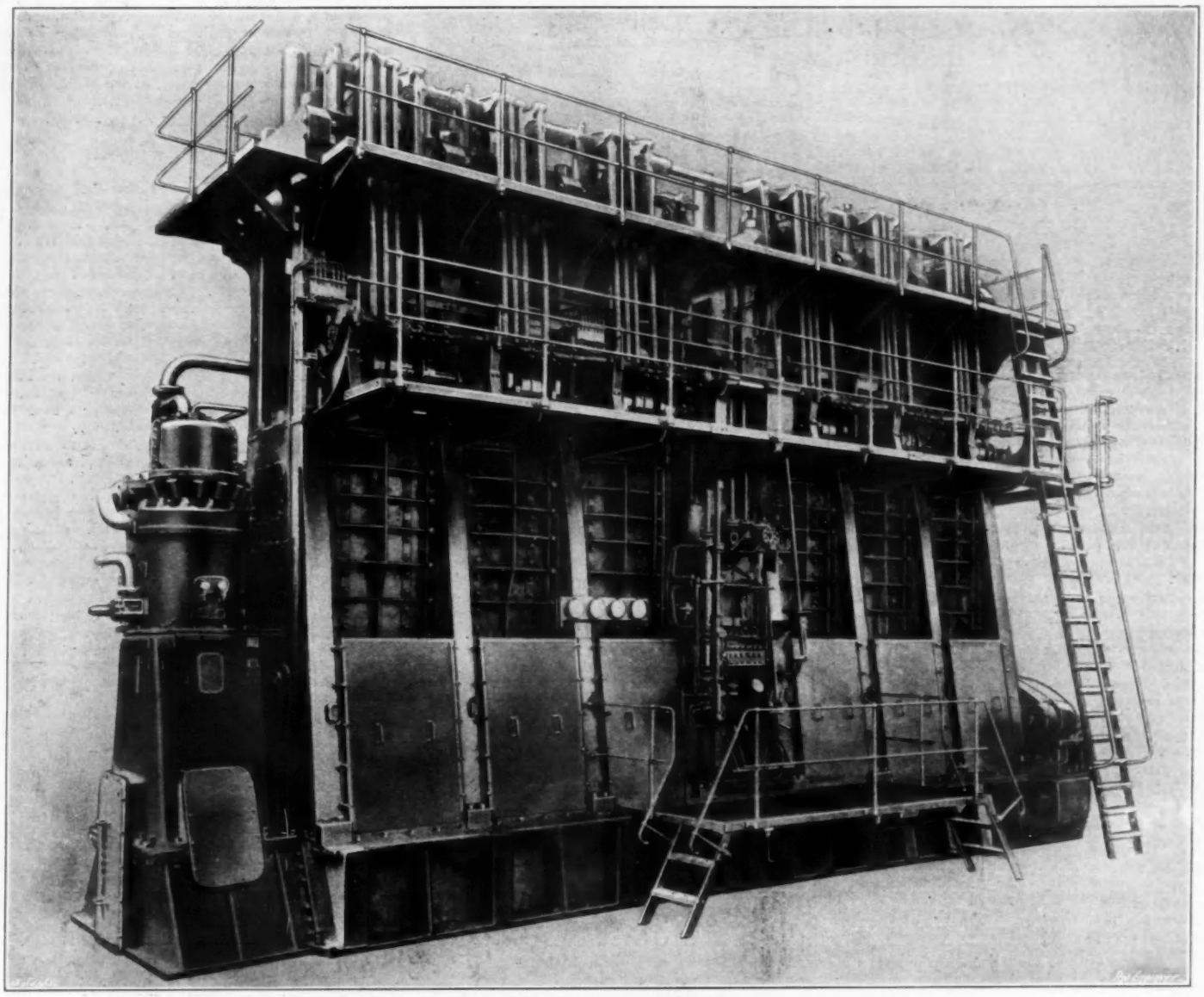
In addition to completing several large marine Diesel engines for their own orders, Messrs. Sulzer Bros. have given considerable assistance to their European licencees, and have carried out a large amount of new experimental work. During the year a special Lloyd's surveyor was appointed for the exclusive marine work of Switzerland, with residence at Winterthur.

Italy.

In the industrial reconstruction which has taken place in Italy, engineering and the building of motor ships have played a prominent part. The trading results of the three Ansaldo San Giorgio motor vessels, owned by the Società Nazionale di Navigazione, Genoa, have clearly shown the value of the motor ship to a non-coal-producing country like Italy. Although the effects of the Italian labour upheaval were reflected in the lessened activities of the Italian yards, progress was made and several vessels were laid down in 1921. One of the most recently

ment by the decision of the Ambassadors' Conference, which allowed high-speed Diesel engines originally intended for submarines to be utilised in commercial vessels, and several smaller ships have been fitted with high-speed engines of the submarine type liberally rated as regards power and speed.

One of the most interesting of such installations is the motor ship Havelland, a cargo vessel of 10,235 tons deadweight capacity, in which twin ten-cylinder M.A.N. four-cycle engines are used. They develop together 3300 shaft horse-power at 230 revolutions per minute, and drive the propellers through reduction gearing, having a ratio of 1 to 2.7, giving a propeller speed of 85 revolutions per minute. This vessel has recently completed a successful maiden voyage from Hamburg to New Orleans. It is of interest to note that during the trials, the torsional stresses on the shafts and gears were investigated by means of a photographic method, and the results obtained were found to be quite comparable with those attained in good steam turbine practice. Several other motor ships were laid down at Messrs. Blohm and Voss's yard for the Hamburg-America Line, some of which may be



1500-I.H.P. LONG-STROKE ENGINE FOR THE LEISE MAERSK—BURMEISTER AND WAIN

will operate on the Java trade route. The Kedoe is a standard 6500-ton ship, equipped with twin six-cylinder 1300 indicated horse-power Burmeister and Wain type engines.

France.

French motor ship developments have been somewhat retarded by the acceptance of surrendered German tonnage, but progress has been made by various licencees of the leading makers of Diesel engines, and several interesting designs of high-speed engines have been evolved, notably the "Renault" marine Diesel engine, described in our issue of October 14th.

Developments are expected with the Schneider marine Diesel engine, and the coming year will be characterised by greater activity.

Belgium.

The resumption of the building of large Diesel engines by Messrs. Carel Frères, Ghent, will again bring Belgian designs into the prominence they deserve.

launches from the Spezia yards of the Ansaldo San Giorgia Company, was that of a cargo sihp of the "Ansaldo San Giorgia" type, the Vejo, built for the Società di Navigazione, Roma, and engined with two two-cycle standard Ansaldo engines, each developing 2200 brake horse-power. This vessel will trade on the South American route. Messrs. Tosi Bros., of Legnano and Tarranto, also completed several motor ships during the year; chief among them is the Ardito, built for the La Platanese Shipping Company, of Genoa. A cargo vessel of 8000 tons deadweight capacity, the Ardido, is engined with two six-cylinder Tosi four-cycle engines, each developing 1250 shaft horse-power at 125 revolutions per minute. The Tosi patented valve gear, described in our issue of November 11th on the Beardmore-Tosi engine, is also fitted to these engines. During the year Messrs. Orlando have acquired the Italian rights of the "Still" engine, and development work is shortly to be begun.

Germany.

The programme of motor ship construction in Germany was undoubtedly modified at its commence-

engined with double-acting two-cycle machinery of improved but similar design to the engines of the motor ship Fritz. At the Deutsche Werft, near Hamburg, motor ships of 4000, 5500, 6500 and 8000 tons deadweight capacity with standard Burmeister and Wain type engines and auxiliaries are under construction for various German shipping interests, the engines being supplied by the A.E.G., of Berlin. Considerable interest is being evinced in the application of the "Steinbecker" principle of solid injection to the marine oil engine, and experiments have been carried out with a 160 brake horse-power two-cylinder test engine at the Krupp shipyards which prove that fuel oils containing a high percentage of asphaltum may be safely and economically used.

Profiting by careful observation of the successful building and operation of motor ships in Scandinavian countries, German shipping companies during the past year commenced the building of a large mercentile fleet, and no effort is being spared to regain the prominent position Germany held with regard to internal combustion engines and motor ship developments prior to 1914.

A Seven-Day Journal.

Goodwill in Industry.

IN a New Year's message to industry, Lord Blyth directs attention to one or two fundamental considerations. He expresses a belief, which will be generally shared, that one result of the industrial struggles from which we have recently emerged is a wider recognition of the fact that the greater efficiency of British industry is largely a question of employer and employed working harmoniously together. He rightly insists that an unsatisfactory part of the present industrial system is the lack of the personal touch between employer and employed which existed in former days. He reminds the workers, however, that labour cannot secure higher wages than an industry can bear, and that this truth must be recognised. Intelligent working men are, however, as he points out, no longer duped by the heresies of extremists, and workers generally are beginning to understand that so far from being the sole creators o. wealth, they would be impotent without the inventor who gives them machinery, of the organiser who makes or discovers markets, and of the capitalist who is the foundation of all enterprise. A similar spirit is revealed in the letter which Sir William Noble has addressed to the Press. This well-known industrial leader bases his hopes on a revival of trade prosperity on what he terms the renaissance of confidence. The subtle and almost spiritual quality which we connote with the word confidence is to trade and industry what the summer is to harvest. Trade during the past year has grown stagnant through fear, and it is the paralysis of fear which must be healed if trade is to regain health and strength. Confidence begets enterprise, and Sir William calls upon all, whether they belong to the capital or labour parties, and indeed every citizen, to help to bring about an increase in the common stock of goodwill and courage, so that the problems of the New Year may be faced with a prospect of their early solution.

Unemployment in Shipyards.

THE serious character of the unemployment problem, and the extent to which it has been aggravated in some of the principal shipyards by the suspension of the contracts for the new battle-cruisers, has led to the decision to call a meeting which is to be held at Newcastle next week. Representatives from Glasgow, Sheffield, Barrow, and other centres will be present, and it is probable that arrangements will be made for a deputation to wait on the Prime Minister to urge the claims of the districts named to a share of any Government work which can be undertaken in the shipyards. There is a fear that the construction of the two new capital ships authorised at the Washington Conference will be allocated to the dockyards, as they could probably be undertaken at those establishments, whereas the larger vessels, for which contracts were placed with private firms, could not have been built in the dockyards unless considerable expenditure had been incurred in the reconstruction of the building slips, which would also have been associated with a great deal of delay in laying down the new vessels. As it now appears probable that a considerable programme of submarine and anti-submarine vessels may have to be authorised, the claims of the great yards on the Clyde, and the North-East and West Coasts, will doubtless be urged on the Government. The high percentage of unemployment among shipyard hands makes it necessary that something should be done either to give naval contracts or to provide alternative work.

Improving the Helicopter.

THE attention which is being given to development of the helicopter type of air machine in the United States and in continental countries has led the Air Ministry to seek the sanction of the Treasury to offer a prize of £50,000 for a new design of helicopter which will comply with conditions to be laid down by the Ministry. The object of the competition, which will be thrown open to designers in all countries, is to evolve a machine capable of rising by its own power to a height of 2000ft., carrying an airman and sufficient fuel for one hour's flight, to remain stationary for 30 min. in a 20-mile wind, to descend in a wind of that force with the engine cut off without horizontal motion and to be capable of horizontal flight at the height of 2000ft. at a speed of 60 miles an hour.

Helium for Airships.

ATTENTION is being focussed on the tests which are being carried out at the Naval Air Station, Hampton Roads, with a non-rigid airship filled with helium. The main object of the experiments is to determine whether this non-flammable gas is suitable for use in airships, and it is intended to collect data as to buoyancy, permeability of fabric and other questions which are of importance in this connection. The gas is somewhat heavier than hydrogen, and it has not hitherto been possible to obtain it in the same condition of purity as that in which hydrogen is supplied. Hopes are entertained, in view of the great scarcity of helium, that it may be possible to form a non-flammable mixture with hydrogen in the proportions of about 7 parts of hydrogen to 1 part of helium. An alternative method would be to inflate an outer cover of the airship with helium as a protective layer, and it is probable that there are other methods in which helium might be employed to minimise, if not to eliminate, the fire risk in airships. It is not yet known, of course, whether the result of the experiments now in progress will be made public, but it is hoped that the records of the tests will not be regarded as Service secrets and publication refused. The supplies of helium are so small that, until new sources have been opened up, it will be difficult to repeat the experiment now being undertaken.

Vickers-Armstrong Austrian Interests.

THE extent to which some of the great armament firms are extending the range of their activities is illustrated by an official announcement regarding the acquisition by the Vickers and Armstrong companies of interests in Austria. It is stated on the authority of the Austrian Government that an offer by the companies named to purchase the Woellersdorf Arsenal is being considered, and that if the deal is completed this great armament factory will be converted into works for the manufacture of locomotives for Balkan railways.

Mersey Tunnel or Bridge.

THE project for improving the transport facilities of the Liverpool and Birkenhead area by the construction of a bridge or tunnel continues to receive the attention of the local authority. The Liverpool City Council had before it on Wednesday a motion which was adopted to appoint a special committee to confer with local authorities and bodies having jurisdiction on both sides of the Mersey, and with the Government Departments concerned, to report on a scheme for securing greater efficiency and economy in local transport services. The committee is to have power, if desired, to engage the services of an eminent consulting engineer to investigate and report fully on the subject. There is a general consensus of opinion that, even if the plan of Mr. Maginnis to convert the existing Mersey railway tunnel under the river for the purposes of road transport were adopted, it would only meet the needs of the immediate future and that an additional tunnel or bridge would have to be constructed.

Railway Rates Reduction.

As might have been anticipated, a campaign on behalf of the principal trade organisations for a general reduction of railway rates is being organised. At a preliminary meeting convened under the auspices of the Federation of British Industries on Tuesday, it was decided to press the railway companies for the percentage reduction now granted for a few commodities to be extended to all merchandise traffic. It was pointed out at this meeting that as rates and charges, when increased, affected all branches of traffic, reductions should be made on the same principle. The General Federation of Trade Unions, which has also had this subject under review, has issued the report of a deputation which recently waited on Mr. Arthur Neal, Parliamentary Secretary to the Ministry of Transport. Mr. Neal held out little hope that any further immediate reduction would take place, as the financial aspect of the question had been entirely changed by the losses sustained during the recent coal strike. Trade Union representatives were informed that the process of adjusting rates when the present groupings are completed would be the task of the new Railway Rates Tribunal.

Composition of Domestic Gas.

THE statement made by Dr. Charles Carpenter, the president of the South Metropolitan Gas Company, that any risk of domestic gas containing an excessive proportion of carbon monoxide has been eliminated owing to the present method of control, has been challenged. If the public wants to be protected from the admitted dangers inherent in a high percentage of carbon monoxide in domestic gas supplies, they are advised not to trust either to the Board of Trade or to its new experts, but to insist upon Parliament enacting a reasonable statutory limitation of this dangerous ingredient. It is asserted, and the criticism will be accepted in many quarters as a sound one, that the quality of gas now supplied for domestic purposes is far below the pre-war standard. This circumstance, coupled with the high prices charged for gas, has produced a deep and widespread sense of dissatisfaction. The time is opportune, in Dr. Bone's opinion, for a review of the whole question, and of the relation of the gas industry to the fuel economy campaign and its correlation with electric power schemes. It is suggested, therefore, that a strong and disinterested public commission should be appointed with terms of reference wide enough to ensure the hearing of all sides of the question. Mr. W. J. Smith, the Secretary of the National Gas Council, defends the present position on the ground that the Departmental Committee of the Board of Trade reported in July last that it was not necessary or desirable to prescribe any limitations of the proportion of carbon monoxide in gas used for domestic purposes. Others who have contributed to the discussion suggest that the Fuel Research Board is doing all the work that is necessary and that there is no need of a new committee.

Retirement of Mr. G. J. Churchward.

BY the withdrawal from active service of Mr. Churchward, who has been for the past nineteen years the chief mechanical engineer of the Great Western Railway, a notable figure in locomotive engineering will go out of the list of that company's chief officers. The share in the development of the steam railway locomotive to its present high position which has been taken by Mr. Churchward is a considerable one. The increase in the working pressure of boilers, the employment of superheaters, and other features which have been incorporated in locomotive design, are among the achievements with which he has been closely associated. He has also taken a very practical interest in the technical education of the young engineers employed in the Swindon works, and has borne a large part in local activities, his work in the municipal field being recognised by his election as first Mayor of the incorporated borough. He also rendered conspicuous service in the manufacture of war material in railway workshops. He will be succeeded by Mr. Charles Benjamin Collett, who has for the past two years held the position of deputy chief mechanical engineer at Swindon, after having served for a number of years as manager of the locomotive works. Mr. Collett has given great attention to labour problems, and the knowledge thus gained should stand him in good stead.

Scrapping Capital Ships.

PENDING the drafting of the Naval Treaty, unofficial discussion at Washington has turned on the method to be adopted in scrapping superfluous capital ships. It is understood that all ships outside those authorised by the Treaty must be rendered incapable of warlike operations within sixteen months of the date when the Treaty becomes operative, and broken up within four years. Similar regulations will apply to vessels which are replaced, but each of the Powers included in the Treaty will be permitted to keep three capital ships—two of them for gunnery practice purposes, and a third as a naval barracks.

Refusing to Work.

THE statement which has been made in connection with the loss of a ship-repairing contract at Barrow indicates either that the officials of the Boilermakers' Society have acted with wanton disregard of the interests of their members or that there has been a most unfortunate misunderstanding. It would appear that Vickers Limited had been in negotiation for a rush repair job on an Italian steamship, and to secure the contract it would have been necessary to work during the Christmas and New Year holidays. In spite of the fact that there is considerable unemployment at Barrow, and that holiday rates of pay would have been granted, the local trade union officials who were approached in the matter delayed action pending a definite written request to allow the men to work. The result of this policy of procrastination is that the contract for repairs was lost. The matter ought not to be allowed to rest here. A full explanation of what amounts to a refusal to work is clearly due.

Shipyard Wage Negotiations.

A CONFERENCE will be held during the present month between the Shipbuilding Employers' Federation and the Shipyard Trade Unions to consider the general position of the industry. Having regard to the high percentage of wages in the total cost of production of the shipbuilding industry, it is anticipated that the question of the war-time bonus will come up for consideration. There have indeed already been informal discussions on the subject, but no definite plan has yet been submitted whereby the bonuses can be discontinued. It is, however, regarded as unlikely that any method of discontinuing the bonus except on the instalment plan would be seriously considered.

Locomotives in 1921.

WE suppose the most interesting event connected with railway locomotives during the year was the nature of the steps taken to keep the engines running whilst the coal dispute was in progress and the stocks of fuel had been exhausted. Someone asserted that the railways of Great Britain were being run on German coal and pit props, and though there was perhaps more wit than accuracy in that statement, yet it is a fact that a great deal of German coal was used, and that for the first time in memory wood fuel—old sleepers in many cases—were seen on the tenders and coal bunkers of engines in London stations. In one way or another, the railways—helped by the fact that the coal traffic ceased and the iron traffic came automatically to an end when the supply of coke failed—managed to carry on to the end with reduced services. Oil fuel, as everyone knows, had its chance, but the impression that a great many locomotives were fired with oil is a mistaken one, as the table below shows. From the figures it will be observed that only three companies—the Great Eastern, which has a long experience of oil firing and which employed the old Holden apparatus, the Midland, which fitted a very simple burner designed by Sir Henry Fowler, and the Great Central—attempted anything more than experimental work. Mr. Robinson, we believe, is continuing to use oil firing, but the general experience is that it is more costly than coal, and there is no evidence at present that it will come into extended use on British railways.

Of the engines fitted—as shown in the table below—a good many were express passenger or goods locomotives.

Locomotives Fitted for Oil-burning during Coal Stoppage.

Railway company.	Number of locomotives fitted.	Type of burner installed.
L. and S.W. Rly.	7	6 Scarab, 1 Holden
S.E. and C. Rly.	3	1 Scarab
G.E. Rly.	76	Holden
G.N. Rly.	8	Scarab
Metropolitan	1	Scarab
L. and N.W. Rly.	3	2 Scarab, 1 Unulco
Midland	42	Midland
G.C. Rly.	22	Unulco
N.E. Rly.	1	Scarab
N. Staffs. Rly.	2	Midland
N.B. Rly.	1	Scarab
G.N. of Scotland	1	Scarab
Caledonian	2	Unulco
Highland	1	Scarab
Total	170	

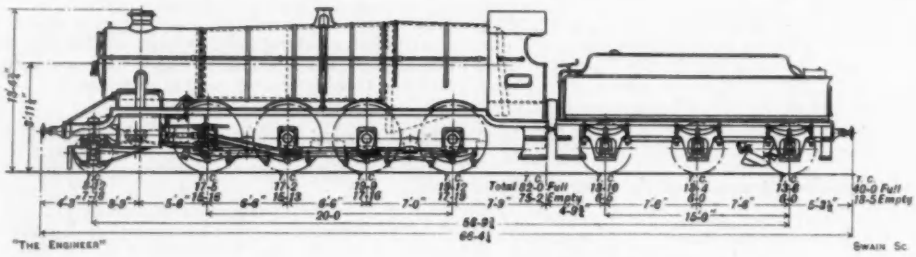
We now give a brief description of the principal locomotive work done by the railway companies during the year.

London and North-Western.

Captain Beames informs us that the efforts of his company during the year were chiefly directed to the improvement of Crewe works, and that no new types of engines were introduced, but a 7ft. four-coupled four-cylinder compound was fitted with a superheater, and is giving very satisfactory results.

London and Brighton.

Colonel Billinton turned out during the year the 4–6–4 (Baltic) engine, No. 329, which is illustrated in one of our Supplements to-day, and which is named Stephenson. It is similar to previous engines of the class. As everyone knows, the electrification of the Brighton main line is imminent, and it is not likely that much new work will be done on steam locomotives.



Cylinders—	
Diameter	19in.
Stroke	30in.
Steam ports	31½in. × 1¾in.
Exhaust	31½in. × 3¾in.
Boiler—	
Barrel	14ft. 10in.
Diameter outside	6ft. and 5ft. 6in.
Fire-box—	
Outside	10ft. × 6ft. 3in. × 4ft.
Inside	9ft. 2⅜in. × 5ft. 2⅜in. × 3ft. 2⅜in.
Height	6ft. 10⅜in. and 5ft. 2⅜in.
Tubes—	
Superheater tubes, No.	96
Diameter	1in.
Length	15ft. 3⅜in.
Fire tubes, No.	218
Diameter	2in.
Fire tubes, No.	16
Diameter	5½in.
Length	15ft. 2⅜in.
Heating surface—	
Superheater tubes	323.90 square feet
Fire tubes	2062.35 ,,
Fire-box	169.75 ,,
Total	2556.00 square feet
Area of fire-grate	30.28 square feet
Wheels—	
Pony	3ft. 2in.
Leading	5ft. 8in.
Driving	5ft. 8in.
Intermediate	5ft. 8in.
Trailing	5ft. 8in.
Water capacity of tender	3500 gallons
Working pressure	225 lb.
Tractive effort	30,460 lb.

G.W.R. LOCOMOTIVE No. 4700 AS RE-BOILERED

Great Western.

We illustrate the Great Western 2–8–0 engine, No. 4700, which was brought up to date and put into service last year. She originally took the road in May, 1919, whilst fitted with the Great Western standard No. 1 boiler, but in July last a standard No. 7 boiler was substituted. It is about 4 tons heavier than the original boiler. It should be observed that, following a modern plan, the steam admission pipes are taken through the smoke-box and coupled externally to the valve chests. In this respect alone does the engine depart from the standard "4300" class of the company. We give a table of dimensions and a weight diagram.

Great Northern.

Owing to the striking success of his three-cylinder locomotives, Mr. Gresley turned out ten 2–8–0 coal engines during the year, an illustration of one of which—No. 477—appears in a Supplement to-day and a line diagram is given above. The total weight of this engine in working order is 75 tons 16 cwt., and of the tender 43 tons 2 cwt. The evaporative surface is 1868.5 square feet in tubes and 163.5 in the fire-box, while the superheater has an area of 430.5 square feet in twenty-four elements. The three cylinders are each 18½in. diameter by 26in. stroke, and the grate area is 27.5 square feet.

Great Eastern.

During the year Mr. Hill built ten more of his 0–6–2 tank engines of the "1000" class, bringing the total number up to twelve. One of these engines we illustrate on page 11. He turned out also two 0–4–0 shunting engines of the "226" class and three 0–6–0 tram engines.

London and South-Western.

In all, fourteen new engines were constructed at Eastleigh during the year; seven of them are heavy six-coupled goods locomotives of the class illustrated in our issue of April 30th, 1920. The remaining seven were tank engines of a new design, three with six wheels coupled and three with eight wheels coupled. An illustration of the latter appears in one of our Supplements to-day, and a weight diagram and general view of the former are given on page 11. The eight-coupled engine was designed for working heavy goods trains and shunting them in the Feltham Gravitation Yard. It weighs in working order about 95 tons. The wheels are 5ft. 1in. diameter, and the two cylinders are 22in. diameter by 28in. stroke. The boiler pressure is 180 lb., and at 85 per cent. of it the tractive effort is 34,000 lb. The total evaporative surface is 1406 square feet, and an Eastleigh superheater with 231 square feet is fitted. The grate area is 27 square feet. The tanks hold 2000 gallons of water and the bunker 3½ tons of coal. The six-coupled engine has the same boiler, but the cylinders are 21in. diameter in place of 22in., and the total weight is 96 tons 8 cwt. The tractive effort is 28,200 lb.

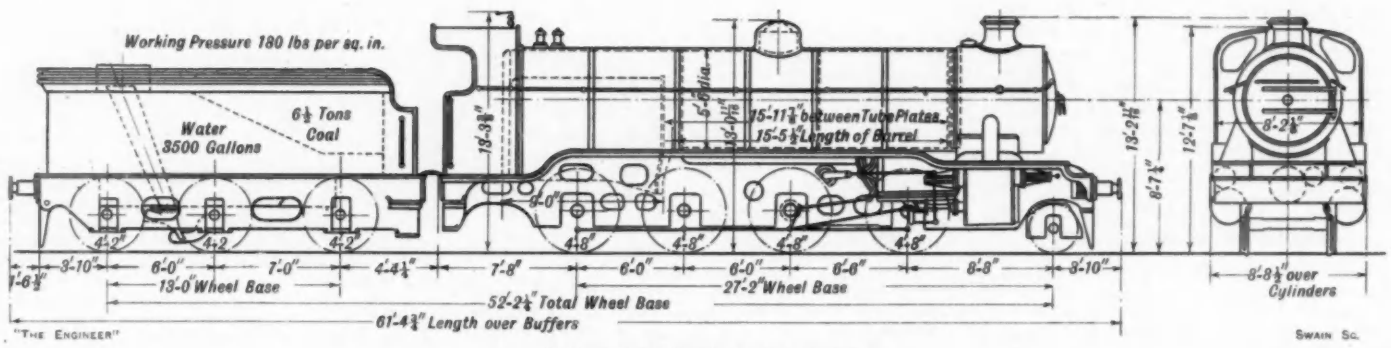
South-Eastern and Chatham.

During the year ten more engines, known as Class "D 1," rebuilt as superheaters to the designs of Mr. R. E. L. Maunsell, were put into service. The rebuilding was carried out by Beyer, Peacock and Co., Limited, Manchester, and from the table of dimensions given it will be seen that as far as possible the main parts, such as boiler, cylinders, &c., have been made to interchange with corresponding parts of the rebuilt engines Class "E 1," which were put into service last year. The table of dimensions below shows the comparison before and after rebuilding.

Table of Dimensions Showing the Comparison Before and After Rebuilding.

	Original saturated engines. Class "D."	Original saturated engines. Class "E."	Rebuilt superheated engines. Classes "D 1" and "E1."
Cylinder—			
Diameter, inches	19	19	19
Stroke, inches	26	26	26
Valves	Slide	Slide	Piston (10in. dia.)
Wheels, diameter	6ft. 8in.	6ft. 6in.	*6ft. 8in. †6ft. 6in.
Heating surface—			
Tubes, square feet	1265	1396	—
Large tubes, square feet	—	—	322.25
Small tubes, square feet	—	—	827.6
Fire-box, square feet	124	136	127.13
Superheater, square feet	—	—	228.0
Total, square feet	1389	1532	1504.98
Grate area, square feet	20.3	21.15	24.0
Working pressure, lb.	175	180	180
Tractive effort at 80 per cent. of working pressure, tons	7.33	7¾	7¾
Total weight in working order—			
Engine, tons	50	52¼	†52¼ *51¼
Tender, tons	39	39	39

* Class "D 1." † Class "E 1."



C.N.R THREE-CYLINDER COAL ENGINE

Lancashire and Yorkshire.

The only new engine built at Horwich during the year was the 4–6–0 superheater express locomotive described in our issue of April 15th last.

Caledonian.

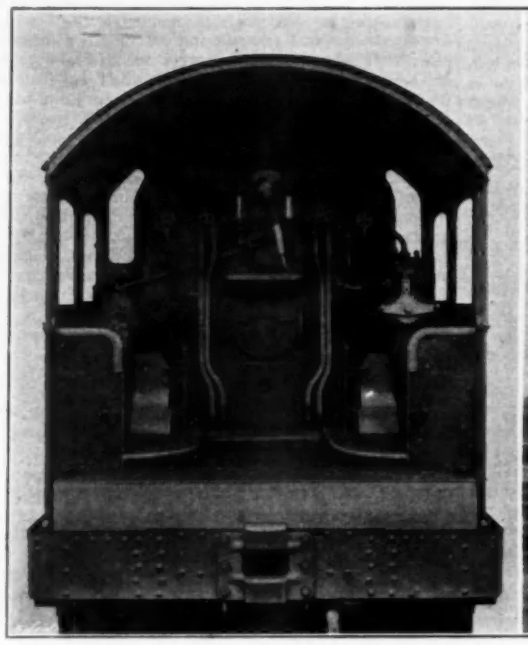
A new type of three-cylinder express passenger locomotive was put into service by Mr. Pickersgill during the past year. An illustration of it is given in one of our Supplements in this number. It is designed to work express passenger traffic, and has a tractive effort of 28,000 lb. at 85 per cent. pressure, Two of the cylinders are placed outside and one inside the frames, the diameters of all being 18½in. and the stroke 26in. Piston valves, with a travel in full gear of 6in., are used. The steam distribution is effected by two sets of Walschaerts valve gear, the inside valve being actuated by the two outsitd motions. The outside cylinders are connected to

the middle coupled wheels, and the inside cylinder to a crank on leading coupled axle. The coupled wheels are 6ft. 1in. diameter. The leading and middle are fitted with spiral and the trailing with laminated bearing springs. The tender is of the usual six-wheeled type, with a water capacity of 4500 gallons, and a fuel space for 5½ tons of coal. It is carried on

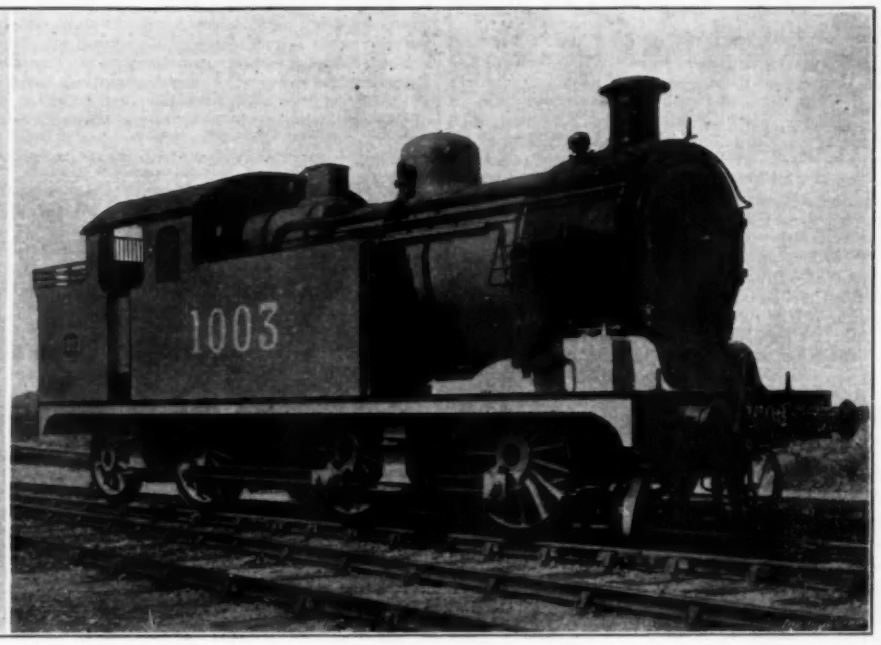
We are informed by Kerr, Stuart and Co., Limited, that they delivered some more of the tank locomotives illustrated in our issues of January 7th and February 4th, 1921, to the Metropolitan Railway, and that they built for the Jodhpur-Bikaner Railway a large number of engines, of which one is illustrated on p. 14.

These engines, which are of the 4–6–0 type and of

wheels are 4ft. 9in. in diameter, and the length of the rigid wheel base of both engine and tender is 12ft. The diameter of the bogie wheels is 2ft. 4½in. The tractive force with 90 per cent. boiler pressure is 15,131 lb., or, say, 6¾ tons, while at 75 per cent. boiler pressure it is 12,609 lb., or 5.63 tons, the ratio of tractive force to adhesion in the two cases being 4.13



FOOTPLATE OF G.C.R. ENGINE No. 73



G.E.R. SIX-COUPLED TANK ENGINE

4ft. wheels, with a base of 13ft. A table of the principal dimensions follows :—

Caledonian Three-cylinder Passenger Engine.

Cylinders, &c.—	
Diameter	18½in.
Stroke	26in.
Valves	Piston
Steam pipes, diameter, inside	4½in.
No. of cylinders	Three
Centre to centre of outside cylinders	6ft. 9½in.
Connecting-rod, outside length	11ft.
Connecting-rod, inside length	6ft. 6in.
Coupling-rod centres	7ft. and 8ft.
Wheels and axles—	
Wheel centres material	Cast steel
Coupled wheels, diameter on tread	6ft. 1in.
Bogie wheels, diameter on tread	3ft. 6in.
Frames, wheel base, &c.—	
Centre of bogie to centre of leading axle	10ft. 3in.
Centre of leading to centre of middle axle	7ft.
Centre of middle to centre of trailing axle	8ft.
Total wheel base of engine	28ft. 8in.
Total wheel base of engine and tender	54ft. 0½in.
Total length over buffers	63ft. 8in.
Boiler, fire-box, &c.—	
Mean diameter of barrel	5ft. 9in.
Length of barrel	16ft. 3in.
Height of centre line from rail	8ft. 10in.
Barrel plates, thickness	9/16in.
Smoke-box tube plate, thickness	13/16in.
Steam pressure in lb. per square inch	180
Tubes—	
Material	Steel
Number, large	24
Number, small	203
Outside diameter, large	5in.
Outside diameter, small	2in.
Length between tube plates	16ft.
Fire-box stays, diameter	1in.
Fire-box stays, pitch	4in.
Heating surfaces—	
5in. tubes	500 sq. ft.
2in. tubes	1700 sq. ft.
Superheater elements	270 sq. ft.
Total	2640 sq. ft.
Grate area	28 sq. ft.
Tender : Wheels—	
Diameter on tread	4ft.
Wheel base	13ft.
Capacity of tanks	4500 gallons
Coal capacity	5½ tons
Weight of engine and tender in working order	129 tons

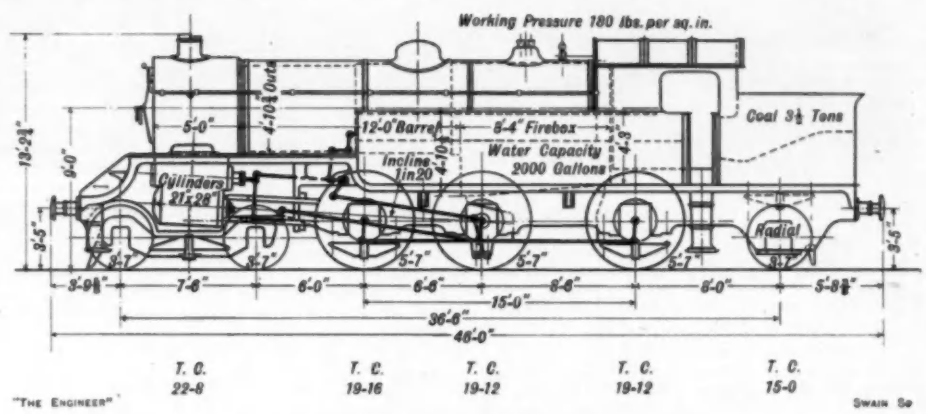
Great Central Railway.

We illustrate in our Supplement one of a new series of express goods locomotives which have been designed by Mr. J. G. Robinson. A view of the cab of the engine illustrated—No. 73—which was built at the Gorton works, is given herewith. These locomotives have four cylinders, each 16in. by 26in., driving on to 5ft. 8in. wheels. The boiler pressure is 200 lb., the evaporative surface is 2044 square feet, while 343 square feet are provided by a Robinson type superheater. The grate area is 26 square feet. The engine weighs 81½ tons and the engine and tender together 130 tons.

Makers' Locomotives.

We turn now to a brief consideration of some of the work done by the private locomotive building firms during the year. It is hardly necessary to say that the locomotive trade suffered as all other trades did during the year from the severe depression.

metre gauge, have a total weight in working order of 36.4 tons, their tenders weighing 29.45 tons, so that the total weight of engine and tender in working order is 65.85 tons. The average weight on each of the three driving axles is 9.3 tons. The cylinders are 16½in.

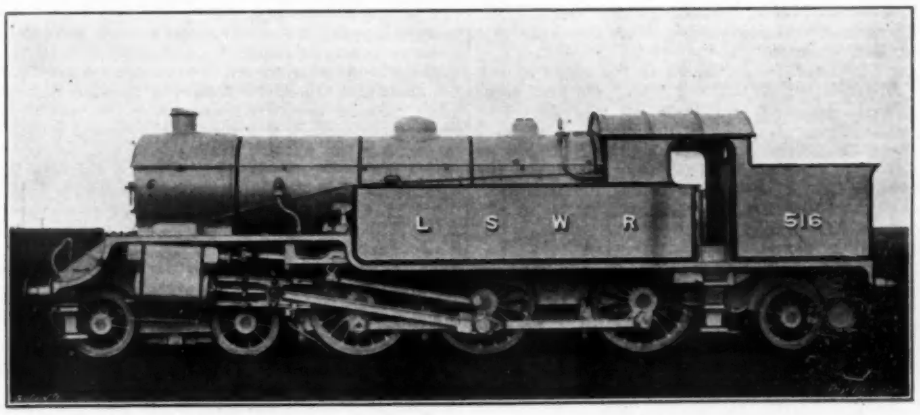


L. AND S.W.R. SIX-COUPLED TANK ENGINE

in diameter, and have a stroke of 22in., and the working steam pressure is 160 lb. per square inch. The heating surface of the tubes, of which there are twelve of 5½in. outside diameter and ninety of 1¾in. outside

and 4.95 respectively. The overall length over engine and tender buffers is 53ft. 8 7/16in. The tender is designed to carry 6 tons of coal and 2500 gallons of water. Messrs. Kerr, Stuart have also built during the year a number of similar engines for the Eastern Bengal Railway, the only difference being the slide bars were not protected by guards as were the Jodhpur-Bikaner engines.

Amongst the work turned out by the North British



L. AND S.W.R. SIX-COUPLED TANK ENGINE

diameter, is 679 square feet, and of the fire-box 107 square feet, or a total of 786 square feet, while the heating surface of the superheater is 151 square feet and the fire-grate area 15.4 square feet. The driving

Locomotive Company, Limited, were two handsome "Atlantics," Nos. 509 and 510, for the North British Railway Company, of which we illustrate one on page 14. These powerful engines have two cylinders,

21in. by 28in., and coupled wheels, 6ft. 9in. diameter. The total evaporative surface is 1803 square feet, and the superheater surface 385 square feet. The grate area is 28.5 square feet. At 75 per cent. of the working pressure of 180 lb., the tractive effort amounts to 20,580 lb. The weight of the engine in working order is 76 tons 14 cwt., and of tender, with 4240 gallons in the tank and a full supply of coal, for which 315 cubic feet of space are provided, 46 tons 11 cwt.

We illustrate also a metre gauge "Mallet" articulated compound locomotive built by this firm for the Burma Railways. It has two high-pressure cylinders of 15½in. diameter and two low-pressure cylinders of 24½in. diameter, with a common stroke of 20in. All the wheels are 3ft. 3in. diameter. The working pressure is 180 lb., and with 50 per cent. of it a tractive effort of 22,170 lb. is attained. Saturated steam is used, and is generated on a surface of 1442 square feet by a grate of 33 square feet. The engine turns the scale at 59½ tons, and draws a tender which in working order with 2140 gallons of water weighs 36½ tons. The illustration below shows a six-coupled engine for the 3ft. 6in. gauge, of which deliveries are now being made by the North British Locomotive Co., Ltd., to the New Zealand Government Railways. These locomotives have 17in. by 26in. cylinders driving 4ft. 6in. wheels, and they weigh 51 tons with a tender of 33 tons 11 cwt., all in working order. A tractive effort of 18,780 lb. is given with 75 per cent. of the normal boiler pressure of 180 lb. The evaporative surface measures 1150 square feet, and a superheater of 155 square feet is fitted. The grate area is 33.3 square feet.

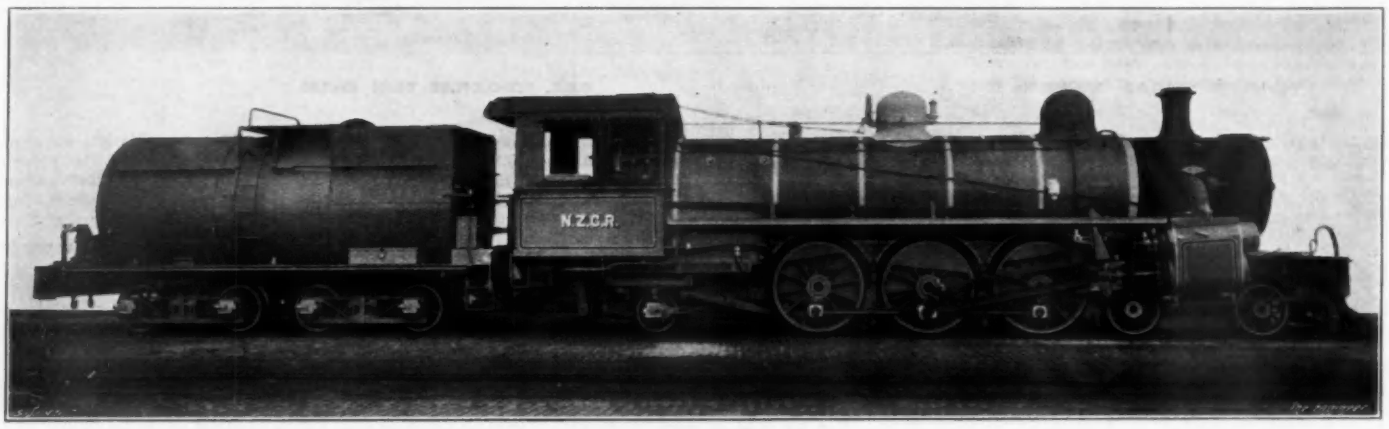
The Vulcan Foundry Company turned out several heavy fast goods engines to the designs of Mr. J. G. Robinson for the Great Central Railway. These locomotives are of exactly the same type as those referred to above and illustrated in the Supplement.

For the Midland Great Western Railway of Ireland Sir W. G. Armstrong, Whitworth and Co. continued to deliver a class of 0–6–0 mixed traffic engines, designed by Mr. W. H. Morton, which are believed to be the first engines expressly intended for mixed traffic introduced into Ireland. The total weight of these engines is 48 tons, or with their tenders 80 tons, and the tractive effort at 85 per cent. of the boiler pressure is 20,500 lb. The cylinders are inside, and they measure 19in. by 26in., and the wheels are 5ft. 8in. diameter. The total evaporative surface is 947 square feet, and the superheater surface is 210 square feet. Other work done by Armstrongs during the year consisted in the rebuilding of 0–6–0 engines for the North-Eastern Railway, 4–6–0 engines for the London and North-Western, and 4–4–0 engines for the same company.

Two locomotives were added to the stock of the Maryport and Carlisle Railway during the past year. They were designed and built by the Yorkshire Engine Company, Limited, Sheffield, to the requirements and under the supervision of Mr. J. B. Adamson, locomotive superintendent of the railway. They are of the 0–6–0 type, with inside cylinders 19in. diameter by 26in. stroke. Saturated steam is employed, and is distributed by balanced slide valves actuated by "Allan" straight link motion. The slide valves are placed above the cylinders, and the exhaust steam is conducted straight to the blast pipe through the back of each valve, there being no exhaust ports in the cylinders. The coupled wheels are 5ft. diameter. The working pressure is 170 lb. per square inch, and the tractive effort at 75 per cent. of it is 19,945 lb. The heating surface is 1407 square feet, and the grate area 19.6 square feet. The tenders are of the six-wheel type, with "horseshoe" tanks. The coal capacity is 4 tons and the water capacity 3500 gallons. The total weight of the engine and tender is 89 tons 8 cwt., and the total wheel base 37ft. 9½in.

For the Great Northern Railway Company of Ireland, five superheater tank locomotives were supplied by Beyer, Peacock and Co., Limited, to the requirements of Mr. G. T. Glover. The gauge of this railway is 5ft. 3in. The engines are of a simple design for working suburban and local trains. The cylinders are 18in. by 24in., driving 5ft. 9in. coupled wheels. The boiler has an evaporative surface of 863 square feet, and a superheater surface of 193 square feet. The engines in running order weigh 65 tons 15 cwt.

Twenty-six per cent. of the locomotives of this company are now fitted with superheaters and piston valves, as in several classes of engine superheaters are introduced when re-boilering is undertaken. Experiments made on three locomotives with slide valves have only been partially successful by reason of the want of space to balance the valves.



NARROW GAUGE LOCOMOTIVE FOR NEW ZEALAND—NORTH BRITISH LOCOMOTIVE COMPANY

Literature.

Metallography. Part II.: The Metals and Common Alloys. By SAMUEL L. HOYT. London: McGraw-Hill Book Company, 6 and 8, Bouverie-street, E.C. 4. Price 28s. net.

THE book before us is the second volume of Professor Hoyt's treatise on metallography, and we find, accordingly, that a full knowledge of the principles and even the methods of metallography is taken for granted. None the less, the present volume constitutes a satisfactory self-contained whole. Indeed, the principal general criticism to be directed against it is that it endeavours to be too self-contained and comprehensive. This will be evident at once when it is realised that the whole range of the pure metals and of all the more usual alloys is treated in the same volume with the alloys of iron and carbon. The refusal to divorce ferrous from non-ferrous metallurgy is, no doubt, to be commended, since logically there is no real distinction between steel in any of its forms and other alloys. But the attempt to deal with iron and steel, including the special steels, in a single small volume together with the whole of the non-ferrous materials, leads to considerable congestion and to some want of balance. Thus the last 320 pages of the book are devoted to iron and steel, leaving considerably less than half this space to the metals and non-ferrous alloys, and even of this a considerable portion is devoted to "iron" considered mainly as a simple metal. As a result of this treatment, the non-ferrous metals and alloys are inadequately treated.

As regard details, there are necessarily many which are open to discussion and criticism. Although the author has clearly made a determined attempt to treat his subject in an impartial manner, he seems to be somewhat unduly under the influence of the German metallurgists with whom, we believe, he obtained his training. Guertler's somewhat academic views, often lacking real experimental confirmation, are freely quoted, while the work of Hanemann is largely utilised so far as the illustrations are concerned, which are well reproduced in spite of the fact that they are printed in the text and not as plates. British metallographic work is more fully considered than is usual in American or continental works, but even so its conclusions are frequently set aside in favour of work done elsewhere, which is, in reality, of far less value. Perhaps the author's worst sin in this respect is in his reference to the work of Rosenhain and Humfrey on the tensile properties of very mild steel at high temperatures. Their curve is described as being reproduced in Fig. 14, yet, as a matter of fact, the figure does not show the original curve, but one in which one of the discontinuities has been deliberately smoothed out. This kind of "editing" is distinctly misleading, and does not serve to generate confidence in the views and statements of an author.

A good deal of space is, necessarily, devoted to the hardening of steel and theoretical explanation of that phenomenon. A very fair and clear account of several of the older theories of hardening is given, but unfortunately for the author, he seems to have entirely neglected some of the most recent developments, which have thrown a new and critical light on the whole question. Thus the paper presented by Westgren at the meeting of the Iron and Steel Institute in May last might, perhaps, have received consideration in a book published—at all events in England—towards the end of 1921. This work, which deals with the X-ray analysis of steel at high temperatures, is not mentioned. More pardonable is the entire omission of recently published results obtained in the study of the hardening of certain aluminium alloys. These alloys themselves are discussed solely on the basis of researches published in America, while results published here, by Rosenhain in his Cantor Lectures of 1919, are ignored. The recent full publication in the report of the Alloys Research Committee could, of course, scarcely be included, but it throws so much light upon the theories of the hardening of steel that it is particularly unfortunate that the one theory omitted by Hoyt is the very one which now seems to be most strongly supported.

The few faults we have indicated are, perhaps, unavoidable in a book dealing with a rapidly growing subject. In spite of them, Professor Hoyt's work is a valuable addition to metallographic literature, and contains an immense amount of information presented in a clear and concise manner.

Copper Refining. By LAWRENCE ADDICKS. London: The McGraw-Hill Book Company, 6 and 8, Bouverie-street, E.C. 4. 1921. 17s. net.

THE author, in the preface to this volume, states that the book comprises a series of articles which have appeared from time to time in that well-known American journal, *Chemical and Metallurgical Engineering*, and that their contents are almost entirely a record of personal experience in a field where but little literature is available. The latter statement requires some amendment, for three books by American authors have already been published on the subject, namely, by Hofman, Peters, and Ulke, the first as recently as 1918. With this preliminary remark the present work may be commended as a very valuable addition to the literature of copper refining. No engineer or chemist, in fact, engaged in this industry can afford to be without a copy of it, especially as the book by Ulke upon "Electrolytic Refining" is now somewhat out of date. The volume under review is divided into twelve chapters, dealing with the following subjects, in each of which the special problems connected with electrolytic refining are discussed, and information and data of great practical value to those engaged in the industry will be found:—Chapter I., Metal Losses; II., Metals in Process; III., Tank Resistance; IV., Current Density; V., Current Efficiency; VI., Impurities; VII., By-products; VIII., Furnace Refining; IX., The Requirements of Refined Copper; X., Copper from Secondary Material; XI., The Power Problem; XII., Elements of Design; XIII., Application to other Fields.

Chapters VII. and XIII. will be found suggestive reading by those interested in other metals than copper. The extent to which the electrolytic process of zinc recovery from concentrates has developed, however, at Anaconda and at Trail, B.C., does not appear to have been realised by the author, when discussing the future of the electrolytic processes for other metals than copper, in Chapter XIII., and it is possible that in time electrolysis will play as large a part in the production of zinc as it now does in the production of copper.

JAPANESE copper companies are agitating for increased customs duties, to save them from the disastrous effects of foreign competition. The price is being maintained fairly firm by agreement, while the restriction of output has resulted in a decided decrease in stocks, but it is doubtful how long the association can keep the situation in hand.

Railway Matters.

A REDUCTION has been made by the railway companies in their charges for shipping coal and coke at the railway-owned docks.

A SPEEDING-UP of the trains on the Metropolitan Railway came into force on the 2nd instant, about 75 per cent. of them having their running time reduced.

IN August last the average receipts per ton-mile for the railways in Great Britain was 3.424d. for general merchandise, 1.261d. for coal, coke and patent fuel, and 1.698d. for other minerals.

THE Edinburgh portion of the West Coast postal train, which left Euston on the night of Thursday, the 29th ultimo, when near Edinburgh ran into a tree which had been blown down in the gale that night. The bogie wheels of the engine were derailed.

IN the report of the Light Railways Investigation Committee, which has just been published, there are a number of recommendations regarding the construction and operation of light railways, the extent to which assistance should be given by the State and local authorities to new schemes, &c.

DURING September last there was, when compared with September, 1920, a decrease of 16.7 per cent. in the number of passenger journeys at ordinary fares and of 27.3 per cent. in workmen's journeys. The average receipts per passenger increased, however, from 15.65d. to 17.7d. The passenger train mileage, despite the fewer passengers, increased by 2.3 per cent.

CITY railway extensions, estimated to cost £4,500,000, are to be proceeded with in Sydney, New South Wales, in order to relieve the existing rail and tramway services. In 1905 the tramways on the southern shore of Sydney Harbour carried 120,973,934 persons; in 1920 the number had risen to 269,255,033. Directly and indirectly the extensions authorised should provide employment for 5000 men.

THERE was a fall of 20.34 per cent. in the total tonnage of goods traffic conveyed in September last as compared with September, 1920, and of 23.01 per cent. in the ton-miles. General merchandise decreased 21.67 per cent. in tonnage and 21.97 per cent. in ton-miles; coal, coke and patent fuel, 12 per cent. in tonnage and 16.48 per cent. in ton-miles; and other minerals 41.40 per cent. in tonnage and 41.79 per cent. in ton-miles. Goods train mileage decreased by 16.4 per cent.

SPEAKING in the chair at the annual meeting of the North Lonsdale Iron and Steel Company on the 16th ultimo, Mr. Myles Kennedy, who reminded his hearers that he was himself a railway director (Furness Railway), said that railway companies would have to reduce their present charges before there could be a revival in the iron trade. It was the duty of railway companies to make traffic pay, but he was convinced that the present extortionate charges would kill the iron trade and every other trade in the country.

SOME interesting information is contained in a recent advertisement of the Underground companies. The first train of the day passes Earl's Court, District Railway, at 5.5 a.m., and the last at 12.57 a.m. During the intervening period of nearly twenty hours 1106 trains pass through that station. At Piccadilly-circus station there are eight lifts which, in a day, make 1500 round trips. There are 233 lifts altogether, and their day's work is about 34,000 round trips. In a year 63 million car-miles are worked to carry 404 million passengers, or a car-mile for every 6.4 passengers.

IN its November monthly report, the Association of Italian Corporations (which is akin to our Federation of British Industries) mentions that the Italian Government is now engaged on a programme for the electrification of 4000 kiloms. of railway trunk lines, comprising some 10,000 kiloms. of track. The whole of the railway system in the highly industrialised provinces of Piedmont and Liguria will be electrified, and in this section 1000 kiloms. of track are already converted. Work is nearing completion on the Genoa-Pisa-Spezia-Leghorn and on the Bologna-Florence and Bologna-Faenza lines.

THE goods locomotives recently shipped by the Westinghouse Electric and Manufacturing Company to the Paulista Railways of Brazil, are now in service in that country between Jundiahy and Louveira. These are the first electric locomotives to be used in Brazil. The new locomotives haul trains of from 43 to 45 "units" over gradients up to 1.5 per cent. The so-called "unit car" is of 10 tons gross weight, and the term refers to the old wooden car of thirty years ago. Modern cars are said to be two, three, or four units, according to their size and load. Thus a train of 45 units represents 450 tons weight, and is approximately 675ft. long. Under former steam operation such trains could not be hauled over a 1.5 per cent. gradient at a speed greater than 15 kiloms. per hour. The electric locomotives ascend such gradients at 45 kiloms. per hour, which means trebling the capacity of the track and greatly increasing the speed of handling goods shipments.

ACCORDING to the Board of Trade returns, the value of the railway material exported during the eleven months ended November 30th last was as follows, the corresponding figures for 1920 and 1919 being added in brackets:—Locomotives, £7,245,355 (£5,197,825, £1,399,523); rails, £2,757,390 (£2,438,747, £1,828,591); carriages, £1,464,461 (£1,553,862, £566,016); wagons, £5,533,490 (£5,213,097, £2,026,722); wheels and axles, £1,603,312 (£1,735,240, £709,841); tires and axles, £1,214,060 (£1,225,318, £809,179); chairs and metal sleepers, £1,346,523 (£1,245,471, £298,255); miscellaneous permanent way, £2,430,196 (£2,176,879, £724,300); total permanent way, £9,586,127 (£8,965,309, £2,886,816). The weight of the rails exported was 145,552 tons (120,252 tons, 114,215 tons), and of the chairs and metal sleepers, 58,815 tons (57,935 tons, 20,539 tons). Locomotives to the value of £287,733 were shipped during November to India, and of £84,340 to South Africa. Rails of the value of £127,842 were shipped to India, of £69,525 to the Argentine, and of £38,530 to New Zealand.

Notes and Memoranda.

THE first Swedish wireless telegraph station for navigation was officially opened at Vinga, off Gothenburg, on November 15th. Three other similar stations are being planned. The station is intended to facilitate the navigation of vessels calling at the pilot station off Gothenburg and all vessels in the Skagerack passing Skagen. It has a radius of over 100 nautical miles.

IN an article on "Electric Heating," appearing in the *Electrical Review* of December 16th, Mr. Julius Frith states that he has kept a bench full of girls warm and cheerful in an otherwise unwarmed room in winter by letting them rest their feet on a long wooden trough lined with slab asbestos and covered with tin containing one 8 candle-power carbon lamp per girl. Examples of local heating under the drawing boards in a drawing-office have proved equally effective and economical.

A RECENT Belgian decree requires that certain goods entering Belgium must be accompanied by a certificate of origin. The Belgian Customs duties have been raised on various articles of German manufacture or imported from Germany, and the certificate of origin is required to allow imports of these goods from other European countries to be admitted at the ordinary tariff rates. The certificate in question consists of a declaration by the exporter, written, stamped, or printed on the invoice, and must bear the *visa* of a Belgian consular official in the exporting country.

THE extraordinary distance at which radio messages can be received is, it is pointed out in *Nature*, well illustrated by the fact that, except when atmospheric conditions are unusually bad, the messages sent from the Post Office station at Leafield are received at Perth, Western Australia. For instance, a news message of 448 words sent from Leafield on December 4th was heard at Perth, and was at once communicated to the Australian papers for publication. The Leafield station is the first station of the Imperial radio chain which is as yet only in course of erection.

THE report of the International Board which has been considering the question of the improvement of Shanghai Harbour recommends:—(1) The dredging of a channel 600ft. long and 30ft. deep in the south channel of the Yangtze estuary; (2) the elimination of the private ownership of wharves, the entire harbour being placed under the International Harbour Commission; (3) the construction of public quays and moorings, also a commercial dock and mail steamer accommodation. It is proposed to build immediately a 600ft. wharf and 2500ft. of berthing. The estimated expenditure on immediate requirements is 10,750,000 Shanghai taels (say, £2,150,000).

THE Paris Prefect of Police is providing his force with a number of motor cars equipped with wireless telephone apparatus, from which it will be possible at any moment to telephone to headquarters or to one another. In the pursuit of criminals and in other police operations requiring great rapidity, much time otherwise lost in using the ordinary public telephone offices, often some distance from the scene of the proceedings, will thus be saved, and the chances of success correspondingly increased. The only point remaining to be settled is the wave length to be used, and regarding it the Police Prefecture is now in communication with the post and telegraph authorities.

AT a well-attended meeting of the Chelmsford Engineering Society, held on December 1st, Mr. J. N. Houblon, of Crompton and Co., Limited, read a paper on "Small Public Electric Supply Undertakings." The lecturer, dealing with the preliminaries necessary to start a small undertaking, said that where steam is to be used the locomobile type of engine is to be recommended, and the semi-Diesel if oil fuel is decided upon. The question of mains was discussed, and it was pointed out that in most cases a well-designed overhead system was more suitable and considerably cheaper than underground, but it is essential for the Government regulations to be modified, as they at present make the cost unnecessarily high.

A WRITER in a recent issue of the *Edgar Allen News* remarks that milling cutters are in some classes of work far more economical to use than the ordinary machine roughing tools. In theory, any single edge of a milling cutter taken in itself will dull as quickly as the edge of an ordinary lathe tool made from the same steel, assuming that both are used on the same work and in the same way. But in practice, the multiplication of edges in a milling cutter enables each edge to take a rest, although the work goes forward continuously. Each edge has, therefore, to do much less work in a given time than the edge of a lathe tool. The single tool will, therefore, be worn out much more rapidly than the milling cutter. Also, and this is a point which should be borne in mind, the greater intervals of rest which each edge of the milling cutter enjoys give these edges a longer time in which to cool after each cut. The cutter can, therefore, be run faster, and this compensates for the heavier cut obtained by the use of a single-point tool working over a much reduced surface.

IN a paper on "Public *versus* Private Supply from a Colliery Standpoint," recently read before the Yorkshire branch of the Association of Mining Electrical Engineers, Mr. Robert Nelson sums up as follows:—In mines where no electrical plant exists, and where it is desired to supplant steam winders, &c., there is no question that a supply from a public undertaking is to be preferred, not only on account of the initial cost of an installation, but also because of the intermittent nature of a colliery load, which necessitates the putting down of a large plant, which will have to give a light output for long periods. In the case of collieries which already have some generating plant of moderate efficiency, the author considers that a change from private to public supply will almost always be found beneficial. Public supply authorities, who, at first, were dubious about supplying collieries, have come to appreciate that the peak loads of individual collieries so arrange themselves as to give a reasonable load factor on the system as a whole, and they are therefore now generally willing to supply on specially arranged terms. Where a colliery has a large surplus of coke-oven gas there are many advantages in co-operation with a public supply authority.

Miscellanea.

A STEEL foundry has been established at Shanglin, near Shanghai, and is said to have a capital of 2,000,000 dols.

THE Government of British Guiana has rescinded its order concerning the mining of bauxite, which prevented further concessions, and new regulations will shortly be issued.

ACCORDING to the Board of Trade *Journal*, H.M. Ambassador at Tokyo reports that by Imperial Ordinance the revised law relating to patents, trade marks, &c., and intituled "The Utility Model Law," will be enforced as from January 11th, 1922.

THE coal output for the week ending December 17th last was 5,026,800 tons, which constitutes a record for the year; the previous highest total was 4,897,700 tons for the week ending January 15th. For the corresponding week last year the output was 5,307,000 tons.

THE recently discovered deposit of iron ore on the shore of Lake Athabaska, Alberta, has been found to contain approximately 21 per cent. silica, 70 per cent. iron oxide, .03 per cent. phosphorus, and .07 per cent. sulphur, with iron in the iron oxide equivalent to 50 per cent.

THE Soochow-Kiansin-Wuchow Long Distance Automobile Service Company has been organised in China, with a capital of 3,000,000 dols. Shares will be entrusted and issued by the Sino-Foreign Trust Company. The total distance is estimated to be 735 li (say, 300 miles).

SOME record outputs are reported from three Doncaster collieries in the *Iron and Coal Trades Review* for December 30th. Working full time and two shifts per week, Brodsworth produced 24,003 tons, Bullcroft over 23,500 tons, and Bentley nearly 22,600 tons. For pits nearly half a mile deep the figures are excellent.

AMONG works recently carried out in Colombia there are a hydro-electrical plant for lighting and power at Tensa. A new telephone system has been installed at Cartagena, and probably will be extended shortly to other districts in the neighbourhood. A new electrical lighting plant has been installed at the pier of Buenaventura of ample capacity to provide the town with the necessary energy for power and lighting.

NEGOTIATIONS for a lumber site and timber preserves in Vancouver are being made, according to *Canada*, by a Japanese firm, which proposes to supply the Tokio market with British Columbia lumber. At the present time Canadian mills capable of turning out dimension lumber are being kept busy by Japanese orders. The International Exhibition in Tokio next year has already brought orders to Pacific Coast mills for 50,000,000ft. of dimension lumber.

THE Peking municipality and the new electric tramway company have come to the conclusion it is unnecessary to order the demolition of the whole city wall. Only a certain portion of the inner city wall will be demolished. It is expected that the Peking tramway company will begin the construction of the lines early next spring entirely with Chinese capital. The four million dollars have been fully subscribed by the Government and the Chinese Bankers' Association.

ACCORDING to a report recently issued by the Transportation Division of the United States Department of Commerce, the volume of tonnage passing through the Panama Canal for the first nine months of 1921 was greater than the total tonnage for any other twelve months, except during the calendar year 1920. For the nine months ended September 30th the total tonnage handled was 7,912,737 long tons. This figure compares with 11,236,119 long tons for 1920 and 7,468,167 long tons for 1919, that being the highest year except 1920.

A SPECIAL scholarship has just been founded at Woolwich by Mr. J. S. Broughton, of Denver, Colorado, U.S.A., who was a trade lad—the equivalent of apprentice—in the Royal Arsenal from 1875 to 1882, in memory of his father and as a stimulus to trade lads. His desire is to enable the most meritorious lads to be fully equipped to enter college and take an engineering degree. He has himself given a large sum of money to be invested, and is also desirous that other successful ex-trade lads should give generously to make the fund sufficiently large to remove all financial embarrassment in particularly deserving cases.

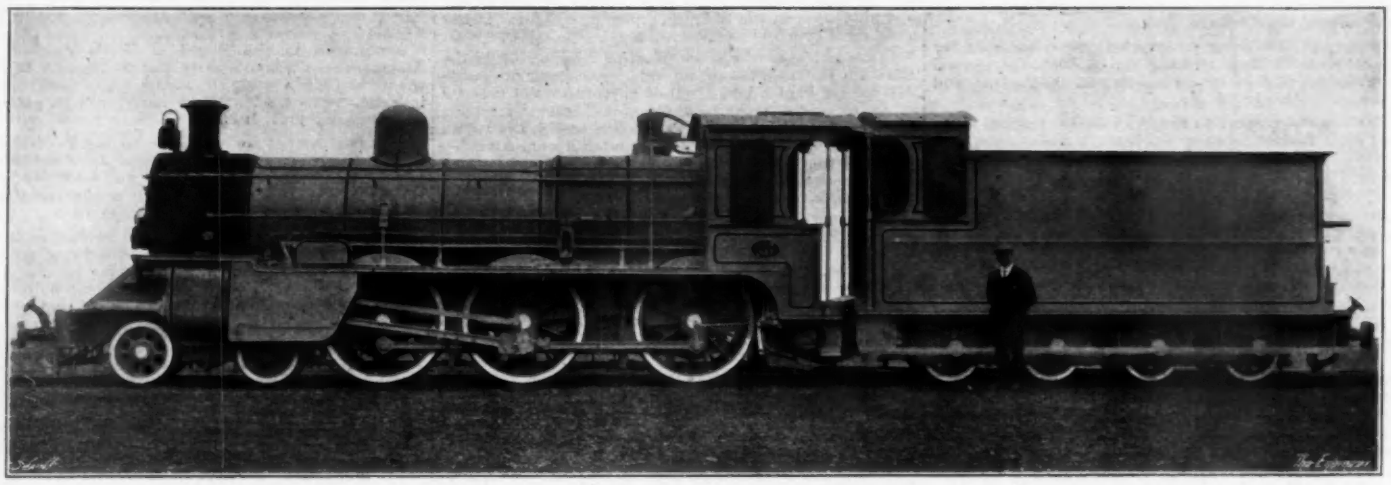
UP to the present, according to the *Berliner Tageblatt*, the Golpa power station at Bitterfeld, from which Berlin receives part of its electric current, was the largest steam power station in Germany. This position, however, will shortly belong to the Goldenberg plant of the Rheinisch-Westfälisches Elektrizitätswerk. The Goldenberg power station has at present a capacity of about 200,000 kilowatts. Half of this amount is provided by two A.E.G. steam turbine sets of 50,000 kilowatts capacity each. The directors of the Rheinisch-Westfälisches Elektrizitätswerk have now decided to increase the equipment of the Goldenberg station by two more units with a capacity of 50,000 kilowatts each. These machines have been ordered from the Allgemeine Elektrizitäts-Gesellschaft. When the new plant is in operation the Goldenberg station, with its capacity of about 300,000 kilowatts, will be the largest of its kind in Germany.

THE budget of the city of Paris for 1922 amounts to the formidable sum of 1,190,000,000f., practically three times that of the budget of 1914, and for the first time for seven years it has been balanced without resorting to new taxation. This excellent result has been brought about by rigorous retrenchment, a policy which is to be continued throughout the coming year. Monsieur Lalou, the budget reporter, is of the opinion that in the future Paris municipal loans should only be issued for the purpose of furthering schemes which will themselves eventually cover both the interest and sinking fund, such as an improvement of the electric power stations on the Rhone that would enable power to be brought to Paris. The 1922 budget provides for a thorough spring-cleaning of Paris, a process which has of necessity been neglected to a certain extent during the war; public buildings will be re-painted and re-decorated, streets will be re-paved, lighting will be still further improved, and public gardens restored to their pre-war beauty.

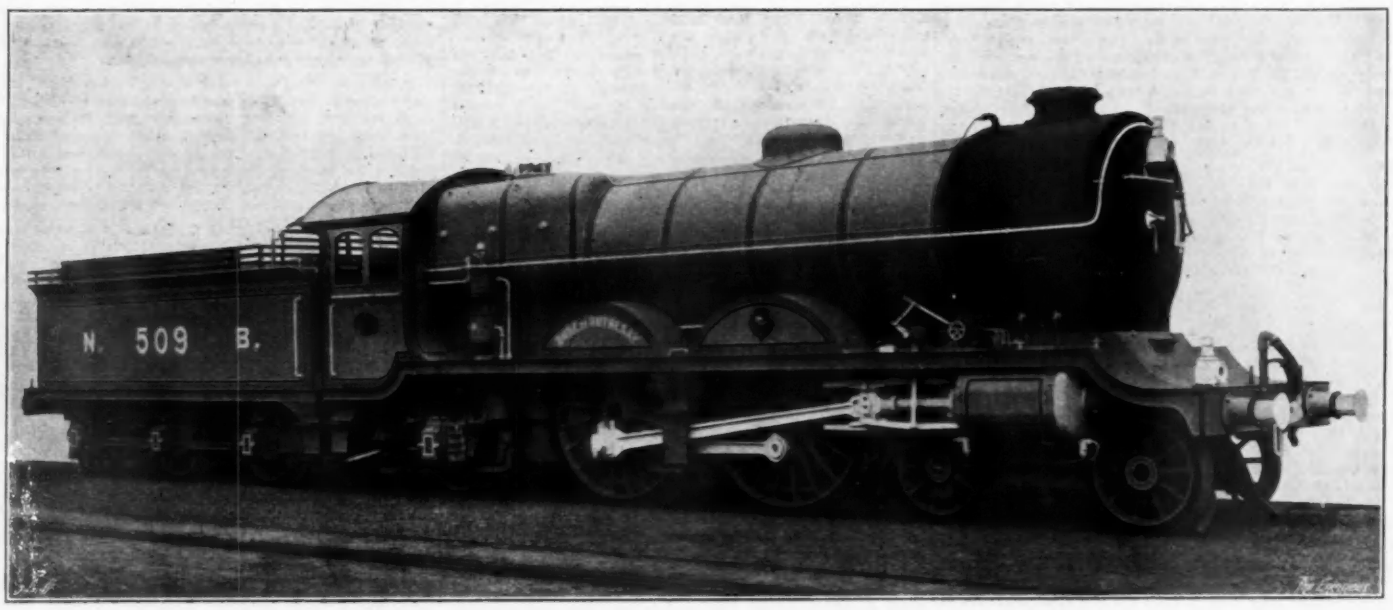
SOME BRITISH-BUILT LOCOMOTIVES OF 1921

KERR, STUART AND CO., LIMITED, STOKE-ON-TRENT, AND THE NORTH BRITISH LOCOMOTIVE COMPANY, LIMITED, GLASGOW, ENGINEERS

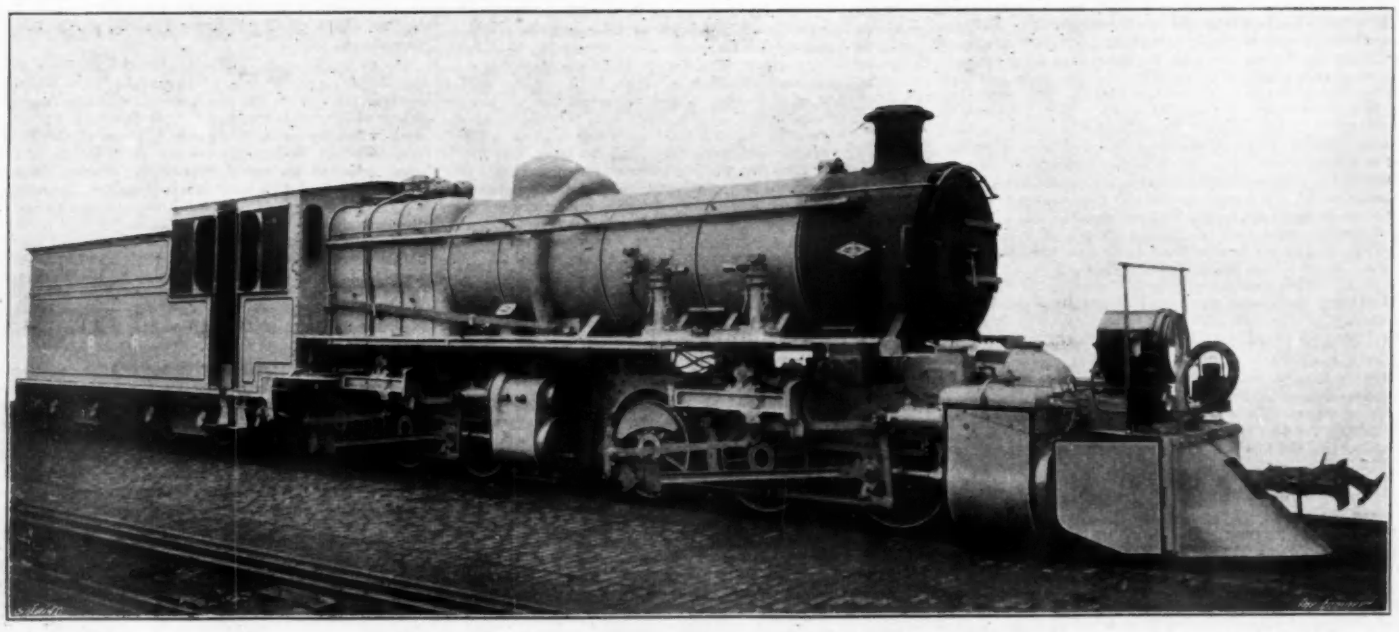
(*For description see page* 10)



JUDHPUR-BIKANER RAILWAY—METRE-GAUGE SIX-COUPLED ENGINE



NORTH BRITISH RAILWAY—ATLANTIC TYPE ENGINE



BURMA RAILWAYS—METRE GAUGE MALLET ARTICULATED COMPOUND ENGINE

AGENTS ABROAD FOR THE SALE OF

The Engineer

BUENOS AIRES.—MITCHELL'S BOOK STORE, 576, Cangallo.
CHINA.—KELLY AND WALSH, Limited, Shanghai and Hong Kong.
EGYPT.—CAIRO EXPRESS AGENCY, near Shepheard's Hotel, Cairo.
FRANCE.—BOYVEAU AND CHEVILLET, Rue de la Banque, Paris. CHAPELOT AND CIE., 136, Bld. St. Germain, Paris.
BELGIUM.—W. H. SMITH AND SON, 78/80, Rue du Marché-aux-Herbes, Bruxelles, and 44, Rue Joseph II., Ostend.
INDIA.—A. I. COMBRIDGE AND CO., Bombay; THACKER AND CO., LIMITED, Bombay; THACKER, SPINK AND CO., Calcutta.
ITALY.—MAGLIONI AND STRINI, 307, Corso, Rome; FRATELLI TREVES, Corso Umberto I, 174, Rome; FRATELLI BOCCA, Rome; ULRICO HOEPLI, Milan.
JAPAN.—MARUZEN CO., Tokyo and Yokohama.
AFRICA.—WM. DAWSON AND SONS, LIMITED, 7, Sea-street (Box 49), Capetown.
C. JUTA AND CO., Johannesburg, East London, and Grahamstown.
AUSTRALIA.—GORDON AND GOTCH, LIMITED, Melbourne, Sydney, Brisbane, and Perth, &c.
MELVILLE AND MULLEN, Melbourne.
ATKINSON AND CO., Gresham-street, Adelaide.
CANADA.—DAWSON, WM., AND SONS, Limited, 87, Queen-street, East, Toronto.
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EIGHT-PAGE SUPPLEMENT—MARINE OIL ENGINES, OCEAN LINERS, LOCOMOTIVES, COMMERCIAL SHIPS, MOTOR SHIPS AND AEROPLANES OF 1921.

THE ENGINEER.

JANUARY 6, 1922.

1921—A Retrospect.

THE tale that is told in other columns of this issue of the progress of engineering in 1921 is far different from that which was anticipated two or three years ago. Whilst many people held that close upon the heels of peace would follow a period of unexampled prosperity, others, basing their opinion on the post-war history of other days, expressed the belief that two or three years would elapse before a marked improvement was seen, and that the summit of a boom would be attained in some five years or so after the end of the war. What actually took place was the arrival of a false boom in the first half of 1920, succeeded by a very rapid decline in the last quarter of that year and followed by a prolonged and deep depression, from which it cannot be said, with certainty, that we are even yet beginning to emerge. A striking feature of this "slump" is its universality. With the possible exception of Germany and Belgium, every country in the Eastern and Western hemispheres is experiencing an unexampled period of unemployment. In Europe the condition is fluently accounted for by high taxation, little money, and excessive costs of production; but in the United States there is no lack of money, taxes are not exceptionally severe, and the cost of labour is not so high as to be repressive. Moreover, America is not obliged to look to foreign markets for the support of her industries, and should easily have found the post-war home demands sufficient to keep her industries fully employed. The fact that she also has a very large ratio of unemployment would seem to indicate that world trade has more influence upon her prosperity than is generally admitted. Whether that is so or not, we have the interesting fact that the only nation which was greatly enriched by the war, the only nation which is not suffering from a dearth of gold sterling, is in a position but little better than the impoverished countries of Europe.

In these curious circumstances, whilst it is natural that we should seek to find the causes of the present unemployment in the salient events of the past year, we are obliged to confess that whilst those causes appear to be sufficient, we cannot say with certainty that they are so in fact. For example, there was some evidence of a revival of trade just before the outbreak of the coal dispute in the spring. But that affair had very little repressive influence on the business of America. Had the revival been really at hand, would not the United States have enjoyed it? Would not they have profited rapidly by the cessation of British industries? Or, to take another view, would it be correct to assume that had the dispute never begun, then not only would Great Britain, but the whole world have witnessed a rapid revival of industry? Again, the efforts made here to deflate the currency are in some quarters held to restrain the development of trade; yet in America, where the same factor exists hardly, if at all, trade is bad. In the same manner we might follow up all the causes that have at one time or another been put forward and find each one fail under some test.

But there is one that seems to us to pass, better than any, all manner of examination. It is the high cost of production to which the chief contributory element is excessive wages *per piece*. The simple fact is that purchasers cannot afford the prices that are still asked. Towards the end of the year the number of inquiries for engineering products of all kinds, and particularly of electrical plant and machinery, increased greatly, but quotations remained too high, and but few of the inquiries were converted into orders. If it should be found possible to lower the income tax in the next Budget, it is probable that a good deal of work will follow on the consequent ability of the manufacturers to take something off the price, but it is inconceivable that the full tide of prosperity can be reached until labour costs are materially lowered. Wages fell during the year, it is true, but it is not by any means certain that the cost of labour was any less, for in many trades the reduction in wages was accompanied by a reduction in output, so that it failed to be effective. Coal, happily, presents a marked exception, for the labour cost per ton had fallen in November to half that which prevailed before the stoppage. Unfortunately, the conditions in nearly all trades favoured the policy of "ca'-canny," and many and many an employer deliberately winked at that bad practice from the humane desire, somehow or another, to keep his people employed. Furthermore, a system of doles to men and women out of work was introduced, and was not only shamefully abused, but encouraged, throughout the year, and is still encouraging a habit of idleness from which it will be difficult to break the recipients.

In such an unfavourable atmosphere as that indicated by what has preceded, it was impossible for great developments in engineering to take place, and looking back over the past twelve months, it is impossible to place the finger upon any great invention or upon any novel work brought to completion, either at home or abroad. Yet it would be wrong to regard the period as one of stagnation, and in one particular at least the evils of the year were balanced by a corresponding good. We refer to the redoubling of efforts to economise fuel and to conserve it by the development of water powers. The enormous rise in the price of coal is causing greater and greater attention to be given to the design of furnaces of all kinds and to the development of means for burning material that was one time rejected. The most notable advance in this direction is the employment of powdered fuel in boilers, which, already established in America, is now attracting great attention here. The dearth of coal during the three months' dispute led to oil burners being fitted in many land power stations, in many locomotives and its use at sea was further extended. For locomotive firing it has almost disappeared again, and for land boilers in general it does not seem likely to compete very seriously with coal. At sea it will continue to be used in increasing quantity, owing to the facility of handling, but the year presented many indications that the internal combustion marine engine has at length become firmly established where small and moderate powers are called for. Besides the familiar types, two new engines made progress during the year—the Doxford opposed-piston type, as seen on the Yngaren, and the Still engine, of which a set for a ship was built by Scotts, of Greenock, and officially tested by Captain Sankey. The results of the tests have not yet been published.

The internal combustion turbine is still where it was, and there is no progress in its development to report. The Humphrey internal combustion pump passed during the year into the hands of William Beardmore and Co., and it may be hoped that the progress that was checked by the war will continue. A very interesting step in internal combustion engineering is the successful operation of the sewage gas suction plant at Birmingham, which was described in our issue of December 23rd. The simplicity of the arrangements and the high thermal value of the gas seem to render it probable that this striking utilisation of a by-product will be widely adopted.

In railway engineering, either as regards locomotives or roads, there is little to say. Mr. Gresley

continued to build three-cylinder engines, and there is little doubt that his success will lead to the further use of three-crank locomotives. But the only important engines of the year are as yet incomplete—a large steam locomotive being built by the Yorkshire Engine Company and the electric passenger locomotive, illustrated by a drawing in our last issue, which Sir Vincent Raven is completing at Darlington. In railway engineering little has been done. The congestion at many of the London termini is worse than ever, and a solution for the difficulty will have to be sought. In some cases, notably at Liverpool-street, the adoption of a double-deck station, in order to get over the trouble of the bottle-neck, may be suggested. In civil engineering of other kinds, the most important event of the year in Great Britain was certainly the completion and opening of the Royal Albert Dock Extension.

But in no respect is the paucity of the year more clearly marked than in that of warship construction. We have no record to make of the launch or completion of any great or notable ship of war. Since the Armistice, work of the kind has almost ceased, but interest was kept alive and imagination quickened by the intention of the Government to lay down four enormous vessels in which the accumulated experience of the war at sea would be embodied. The designs of these ships—which would have cost over seven million pounds apiece, —were practically complete and the preliminary contracts had been placed, when the limitation of armaments proposals were made at Washington, and all work on them was incontinently stopped. In place of them, two first-class vessels will be constructed, but entirely new designs must be prepared. In a special article on "Warship Construction in 1921" we shall discuss the effect of the Washington decision, and it is only necessary to say here that, desirable as the limitation of armaments may be from the point of view of national finance, it cannot fail to have serious effects upon labour in this country for several years, and may, as well, delay technological science of all kinds to an extent which it is impossible to foresee.

Bad though the record of the year is, let us hasten to add in conclusion that the end was better than the beginning. All through the twelve months prices of nearly all commodities fell steadily and labour, aroused to the real position by the irrefutable logic of economic events, was departing from the attitude of the earlier months, and in a great many trades accepting rates of wages which a few months earlier it had refused to consider. We have already alluded to the improved position of coal, but owing to its importance a word or two more may be added. In 1920 the average weekly output of coal was roughly 4,400,000 tons; in 1921, just before the stoppage, it had fallen by 100,000 tons; by the end of the year, despite the fact that over a quarter of a million men were unemployed and a great deal of short time was being worked, it had risen to over 4,600,000 tons The output per man had nearly doubled, and the labour costs, which began at 30s. per ton, fell to 15s. This is one of the most hopeful signs of a real revival of trade. Towards the end of the year the Government, too, awoke to the fact that it could not afford the magnificent schemes on which it had embarked, and began seriously to study the reduction of expenditure. The Ministry of Transport, one of its most costly luxuries, came to an end, and Sir Eric Geddes, who was responsible for its creation and for its grandiose proportions, was appointed chairman of a Committee which is still engaged studying all possible directions in which national expenditure can be reduced and the burden on the taxpayer diminished. Furthermore, invitations have been issued to several nations to join in an Economic Conference at Cannes, which it is hoped may discover some means of settling the money tangle of the world.

All these things give cause for hope, but yet greater than them all is the fact that the war is receding every year further back, that its evil consequences are gradually disappearing, and that the world is returning to its normal peace condition.

Harbours and Waterways in 1921.

No. I.

THE general depression of trade, the financial situation and the high cost of labour continued, during the year 1921, to prevent public works construction in connection with harbours, docks and waterways in this country being undertaken, except to a very limited extent. Although the cost of labour showed a marked decrease, especially during the latter part of the year, it has not yet reached a level which is sufficiently low to induce port authorities and others to embark on programmes of construction and development which entail large expenditure. Consequently, the works in hand during the year, so far as the United Kingdom is concerned, were either the continuance of construction undertaken in the pre-war period or the execution of renewals or new works which for various reasons could not economically be postponed.

In the first category are the two large dock extension schemes of the Port of London Authority and the Mersey Docks and Harbour Board respectively, both dating from pre-war times and both delayed by the circumstances of the war. The former was completed during the year and the important addition thus made to the dock accommodation of the Port of London was opened by his Majesty in July and named by him the King George V. Dock.

In the United States of America, and perhaps to a lesser extent in Canada, the situation was very different. In the United States vast schemes of port development are in hand or are about to be commenced in almost every harbour of importance, while in Canada the harbour and dock works under construction probably exceed in extent the work undertaken in any pre-war year.

In some other parts of the world, too, much constructional work and improvement of equipment are being carried out, but in South Africa, Australia and New Zealand many schemes are held up by financial considerations.

To return for a moment to the United Kingdom and the prospects of new harbour construction in the future, it is significant to note that the number of Bills of which notices have been given for the coming session is smaller than in any pre-war year, and even smaller than the number of Bills deposited in any post-war year. None is of prime importance, considered from the point of view of magnitude of works, and the total number is five. The most important is the Port of London and Midland Railway Bill in connection with the proposed Tilbury landing stage. Another marks the fifth attempt to obtain powers for the Canvey Island deep-water wharf project in the river Thames, and the three remaining Bills involve no large amount of construction.

In the following survey we refer to many of the important works already in hand or completed during the past year, and, in addition, we have noted a number of projects, some of which no doubt will be actually proceeded with at an early date, while others must be indefinitely postponed.

There are two pronounced tendencies to be observed in nearly all the important schemes of development in United States and Canadian ports. These are in the direction of, first, the remodelling of existing and the provision of new accommodation with the idea of "port zoning," that is to say, the concentration of different classes of traffic in particular sections of port accommodation; and, secondly, the provision of specialised plant and equipment for dealing with particular traffic, such as ores, grain and oil. It is true that a considerable part of the work now being carried out in the ports of the Eastern hemisphere is in connection with oil and grain traffic, but the elaboration of the zoning principle is nowhere so marked as in the North American ports.

At home the attempt on the part of the Government to encourage the execution of public works with a view to the relief of unemployment have not, so far, resulted in any important amount of work being commenced in connection with harbour and dock undertakings, which will receive financial assistance from Lord St. David's Unemployment Grants Committee. The Advisory Committee set up in November under the provisions of the recent Trade Facilities Act has not yet had sufficient time to deal with the many projects submitted, but it is understood that among them are several which propose large expenditure on port works.

The Railways Act, which became law in August, will eventually bring about a great change in the ownership and management of many of the railway companies' docks. On the completion of the several schemes of grouping, all the East Coast railway ports —including Harwich, Lowestoft, Grimsby, Hull, Immingham, the North-Eastern Railway docks at Hartlepool and Sunderland, and on the Tees and Tyne, Grangemouth, Burntisland, Bo'ness and several smaller docks and harbours—will be joined in the Eastern Group. The Southern Group will include Folkestone, Newhaven and Southampton docks, with interests at other ports. The Great Western Group will unite the South Wales ports of Cardiff, Newport, Port Talbot and Barry with the existing Great Western Railway ports and harbours. In the North-Western and Midland Group, Holyhead, Garston, Heysham, Barrow and Fleetwood are the most important harbours, but, in addition, there are numerous ports both in Scotland and England in which this group will have large interests.

In the spring of the year the Board of Trade convened a conference of harbour and shipping interests to consider the question of the pollution of water areas in harbours and docks by oil discharged from ships' oil tanks and otherwise. The rapid growth in the use of oil for bunkers and in the transport of oil in bulk has materially increased the risk of fire damage, resulting from the presence of inflammable oils in restricted water areas. It is understood that the Board of Trade intends as soon as possible to promote legislation dealing with the subject, which will probably include provisions prohibiting the discharge of oil into waters when its presence may be a source of danger.

THE UNITED KINGDOM.

The Port of London.

During the year the Port of London Authority brought to completion and successfully inaugurated two important schemes of improvement, one of which had its inception soon after the Authority came into existence in 1909. This work, the most important scheme of port improvement completed in the United Kingdom during the year, is the Albert Dock Extension, which was opened by the King on July 8th. The work has been in hand for ten years, and although progress was delayed by the war, construction was carried on continuously during that period. The new dock is approached from the river by an entrance lock 800ft. long by 100ft. in width with a depth of 45ft. at H.W.O.S.T. The length of the lock can be increased to 910ft. by utilising a floating caisson. The dock has a water area of 64 acres, the depth over the greater part being 38ft. It is 4500ft. long and varies in width from 500ft. to 700ft. A novel feature is a series of seven reinforced concrete jetties constructed parallel with and just in front of the South Quay. These jetties carry numerous electric cranes, and cargoes can be moved either from or into barges lying between the jetties and the quay or from or on to the quay. A passage 100ft. in width affords communication with the old Albert Dock, and, at the west end of the new dock, a dry dock, 750ft. long, 100ft. in width, and having 35ft. depth over the keel blocks, has been built. Steel gates are used for closing the lock entrance and a floating caisson for the dry dock. Extensive shed accommodation is provided on either side of the dock, but some of the sheds on the north side are not yet completed. In our issue of July 8th, 1921, we published an illustrated description of these important works.

The Port of London Authority, shortly after the opening of the new dock works, concluded a working agreement with Messrs. Harland and Wolff for the use of the dry dock, now known as the King George V. Dry Dock, together with the extensive repairing equipment, which has been provided in connection with it, and an area of land adjoining the dock entrance has been leased to the company. The Belfast firm intends to establish a big ship repairing and engineering yard in the port, and arrangements have been made with it for the maintenance of the Port Authority's floating craft, the existing repair shops of the Authority having been taken over by the company.

The other important work completed by the Port of London Authority during the year is the river cargo jetty at Tilbury, opposite Gravesend. This work was formally opened on June 9th, but was not put into regular use until later in the year, some modifications in the mooring arrangements for ships being found desirable. The jetty is 1000ft. in length and 50ft. wide, with an approach viaduct connecting the rail tracks on the jetty with the Midland Railway lines at Tilbury. The jetty is constructed on three rows of reinforced concrete pile clusters, enclosed in reinforced concrete cylinders, carrying a double-decked superstructure of the same material. The lower deck is used for storage and the upper deck carries tracks for electric cranes and railway wagons. The depth of water alongside the jetty, which lies parallel with the shore, is 30ft. at L.W.O.S.T. The construction of this work marks a new departure, for these deep-water river berths for cargo ships are the first of the kind to be provided by the Port Authority. The cost of the work is stated to have been about £320,000.

In addition to the two works we have referred to above, the Port of London Authority has in hand important improvements at several of its other docks. Plans for large developments in connection with certain of the docks have been approved, but the bulk of the intended work is in abeyance awaiting more favourable industrial and financial conditions for its execution. There is one scheme of considerable magnitude which the Authority proposes to proceed with, if possible, this year; that is the construction of a floating passenger landing stage at Tilbury and a new railway terminus in connection with it, which will be built in conjunction with the Midland Railway Company. The parliamentary notice of a Bill for the session of 1922 to authorise these works was made in November last. The proposed stage, which will be somewhat on the lines of the Liverpool landing stage, is to be 2000ft. in length and 80ft. wide. The depth of water on the berths alongside will be over 40ft. at low water.

In December the Port of London Authority appointed as its general manager Mr. D. J. Owen, at present general manager and secretary to the Belfast Harbour Commissioners. For over ten years there has been no appointment under the Authority analogous to that of general manager.

The Mersey.

In common with most home ports the high cost of constructing public works and the financial situation

still prevent the Mersey Docks and Harbour Board from proceeding with a large part of its programme of developments and improvements. During the year, however, several important works were carried out. Work on the new Gladstone wet dock, for which powers were obtained in 1906, proceeded. The entrance lock is nearing completion and the gates are in course of erection. In the case of this dock, which will measure 1070ft. by 130ft. internally, with a depth over the sill of 48ft. 2in. at H.W.O.S.T., steel gates are being used, and the Dock Board has not followed the precedent made by it when the Gladstone graving dock was built, of using sliding caissons for closing the lock entrance. The communication lock between the new Gladstone Dock and the Hornby Dock has been completed and construction has been resumed, after suspension of work during the war, on the Branch Docks Nos. 1 and 2, which will form the main internal arms of the new Gladstone system. The quays in the dock will provide four additional berths of from 1270ft. to 1590ft. in length with treble-storey sheds alongside. The extension of the Prince's landing stage by the addition of 500ft. frontage, also authorised in 1920, was put in hand during the year. The Dock Board also has in hand the electrification of the whole of the dock property, which for the north side alone will cost about £200,000. The construction of extensive sheds for the colonial wool trade with a capacity of 80,000 bales was completed during the year, and the further revetment of certain parts of the sea channels is in progress. Large sums of money are also being spent in improving the mechanical equipment of the port. At Birkenhead the Dock Board is constructing a new river entrance to the Alfred Dock on the site of two smaller lock entrances, which will be closed. The new lock will be 600ft. in length and 80ft. wide and will have three pairs of gates. The annual report of the Dock Board shows that the Board's dredgers have removed from the bar and sea channels over 300 million tons of material since the bar dredging was commenced in 1890; the total for the year ending June 30th, 1920, was 3,591,000 tons, in addition to 3,193,000 from the dock entrance, &c. The Manchester Dry Docks Company opened a new dry dock in May.

Bristol Channel Ports.

The Docks Committee of the Bristol Corporation recently completed the reinstatement of Portishead Dock, which will return to its pre-war use, principally in connection with the timber import trade. It will be remembered that the dock was in course of being equipped, when the war ended, for use as a fitting-out basin in connection with the Admiralty merchant shipbuilding enterprise in the Bristol Channel.

The Ministry of Transport Committee, appointed towards the end of 1920, under the chairmanship of of Mr. R. Mason, held an inquiry in November of that year into the alleged insufficiency of the facilities provided at Newport. The report of the Committee, which was issued in July, 1921, indicates that the present needs of the port of Newport are met by the facilities provided by the Alexandra (Newport) Docks and Railway Company; thus no need exists for large extensions of quay accommodation in the tidal river Usk. The Committee recommended a reconstitution of the Newport Harbour Commission, which is the body controlling the river and harbour navigation as distinct from the railway company's docks.

It is reported that a sum in the neighbourhood of a million sterling will have to be spent on improvements and new equipment at the Cardiff Docks, particularly in connection with coal export, as a condition of the taking over of the Cardiff Railway Company's Docks by the Great Western Railway. There appears to be a good deal of local dissatisfaction with the existing equipment of and facilities at the docks, which are stated to be inefficient and not up to date. In the meantime some small progress has been made with the erection of new coal staiths at the docks.

North-East Coast Ports.

On the river Tyne the Newcastle Corporation has commenced the extension of Newcastle Quay. The new work is largely constructed of reinforced concrete piles. The Tynemouth Corporation is building three reinforced concrete jetties at North Shields to provide increased accommodation for the fish trade. A new river quay is under construction at Hebburn for Hawthorn, Leslie and Co., Limited, but, on the other hand, constructional work in connection with several shipbuilding yards on the river Tyne had to be suspended in the course of the year owing to the depressed state of trade and the financial situation. A new dry dock was completed at South Shields, and two existing dry docks—one at South Shields and the other at North Shields—are now being reconstructed and enlarged. The latter will have a novel type of entrance gate, which will be in the form of a single flap hinged at the sill level and falling outwards into the river when the entrance is opened. The North-Eastern Railway Company, having completed the underpinning of the south river pier of the Newcastle High-level Bridge, is now carrying out strengthening works in connection with the north pier.

The work of reconstructing the entrance gates at Seaham Harbour, which were carried away during the heavy gale of November, 1919, was completed during the past year. The gates and protective works have been strengthened, and new strut gates added. The expenditure incurred in making good the storm damage is stated to be upwards of £70,000.

The Blyth Harbour Commissioners have completed the substructure for new coal shipping staiths, which are to be erected at High Ferry, and work on the new west pier is nearing completion.

Holyhead.

The London and North-Western Railway Company promoted a late Bill in 1921 by which it obtained powers to confirm an agreement it had come to with the Ministry of Transport for a 99 years' lease of the whole of the old and inner harbours at Holyhead, including the mail jetty and Ministry of Transport dry dock. That Department under the Ministry of Transport Act of 1919 took over the harbour at Holyhead from the Board of Trade, and the only parts of it now under the active control of the Ministry are the outer harbour or harbour of refuge and the breakwater. For many years the railway company has held a lease of the "new" inner harbour, which it constructed in the 'seventies, and its present intention is to deepen the fairway and berths in that harbour for the accommodation of its largest cross-Channel mail boats at all states of the tide. When this work, which entails reconstruction and underpinning of most of the quays, has been carried out, it is the intention to berth the mail boats at the quays in the inner harbour instead of, as heretofore, at the mail boat jetty further out.

The company has let a contract for the deepening of the harbour, which involves the blasting and removal of some 200,000 tons of rock, in addition to ordinary dredging.

Grimsby.

The Great Central Railway Company has completed the construction of the new fish market at the north end of No. 1 Fish Dock, and a contract has been let for the repair of the quay walls at the entrance to No. 1 Graving Dock. A large amount of reinforced concrete is being constructed in connection with the company's various works for the accommodation of the fish trade of the port.

Falmouth.

The Falmouth Dry Docks and Engineering Company completed the construction of its new dry dock at the end of the year, and it will be put into service as soon as the new power station is working, which is expected to be in the course of the present month. The dock is considerably larger than any of the previously existing dry docks at Falmouth, being 750ft. long in the clear, 88ft. in width at entrance, and it has a depth of 28ft. over the sill at high water. The entrance is closed by gates. The company's ship repairing and engineering establishment has recently been improved and brought up to date.

Scottish Ports.

The Clyde Trustees added to their mechanical equipment at the Meadowside granary during the year. At Whiteinch, near Glasgow, a new riverside quay for the North British Diesel Engine Works was completed, and at Bowling a new basin for oil tankers was brought into use. The old West Harbour at Greenock is being filled up. The committee, presided over by Sir William Raeburn, reported against the expenditure of money on the enlargement of the Crinan Canal.

A Conservancy Commission has been set up for the river Forth, and the harbour and docks at Burntisland were transferred from the old Board of Commissioners to the North British Railway Company.

The improvements at Buckie Harbour on the Moray Firth are now practically completed. The works have been in hand since 1910, but during the greater part of the war period they were practically suspended. Buckie is now one of the best equipped of the East Coast of Scotland ports for steam drifters.

The Fishery Harbour extension at Macduff was opened by H.R.H. the Princess Royal on May 25th, 1921. The new works were commenced in 1914 and provide a water area of 2½ acres and 1500ft. of new quayage.

Financial difficulties prevented the authorities at Peterhead, Fraserburgh and Wick from proceeding with the construction of harbour improvements and extensions for which they have powers. The Wick Trustees also propose an ambitious scheme of extensions to cost £1,000,000, for which they ask Government assistance. Schemes of fishery harbour improvement at other Scottish ports are also held up for lack of funds; amongst them are Eyemouth, Gardenstown, and Lossiemouth. The Portnockie Commissioners are seeking powers in the next session of Parliament for extension of their harbour.

Belfast.

By the Belfast Harbour Act, 1918, the Harbour Commissioners obtained powers to construct improvement and extension works, which were then estimated to cost £2,000,000, but the actual expenditure if the whole of the works were carried out now would no doubt be much in excess of this figure. A small part only of the scheme has been put in hand; the coal quay in the Musgrave Channel is finished; a commencement has been made with the construction of the Abercorn Basin Quay, and another quay in Spencer Dock; still another quay in the Musgrave Channel is well advanced, and oil storage and bunkering installations on a considerable scale are about to be erected.

The Commission is considering the early commencement of work on a reclamation scheme which it is hoped will provide some relief for unemployment. In connection with this, a river embankment is to be formed, behind which dredged material will be deposited and a wharf will be constructed.

Richborough.

Premature announcements in the Press regarding the sale of the war port of Richborough and its equipment to a commercial syndicate were frequent in the early part of the year. Ultimately, however, the conclusion of a bargain between the Disposals Board and a syndicate representing private interests was officially confirmed. The purchase price is stated to approach one and a half millions, and a portion of this sum is to remain on mortgage. The transfer includes not only the port works and fixed equipment, but the whole of the surplus floating craft and cranes, including dredgers, the three Channel train ferry steamers, and numerous tugs and barges.

In October the purchasing company ran an experimental train carrying fruit and vegetables from the South of France to London, the train crossing the Channel from Calais to Richborough, on one of the war-time ferry steamers.

Facilities for Oil Trade.

We have indicated that one of the most noteworthy features of port development in all parts of the world at the present time is the provision which is being made for oil export and import and for bunkering fuel oil. New installations or extensions of existing facilities have been recently completed or are under construction on the river Thames at Thames Haven, at the Herculaneum Docks and on the Dingle Estate of the Mersey Docks and Harbour Board, at Bowling on the river Clyde, in Southampton Water, and at Queen's Dock, Swansea, where the Anglo-Persian Company is erecting a vast import and export establishment in connection with its refinery at Skewen. On the Tyne Jarrow Slake is in course of development as an oil import and bunkering centre, and at Hull the oil establishment at Salt End is being considerably extended. The Bristol Corporation is carrying out works in the western arm of the Royal Edward Dock at Avonmouth, with the view to its use as an oil depôt, and four of the large oil corporations are engaged in laying down installations for oil import, storage, and bunkering. The work of the Admiralty Civil Engineer-in-Chief's Department was restricted during the year, so far as capital works are concerned, almost entirely to the provision of oil storage and bunkering facilities, not only at home ports, but at many of the naval establishments and overseas and colonial ports. Developments connected with the oil trade are also in progress in most of the important foreign and colonial ports.

Schemes Proposed.

Among the projects for harbour and dock development in home and Empire ports which are of present interest are the following:—The Thames deep-water wharf scheme, to construct a river wharf at Canvey Island, has been revived, and a fifth application is to be made to Parliament in the session of 1922 by its promoters. The Mersey Docks and Harbour Board proposes, when circumstances permit, to develop further the Dingle Park Estate, and it has acquired land on the Cheshire side of the river for further developments of its Birkenhead dock system. It is also considering a big extension of the Liverpool docks stretching up to Waterloo, which will be served by the new Gladstone Dock entrance. The Clyde Trustees have done some preliminary work in connection with the Shield Hall and Renfrew basin scheme, estimated in pre-war days to cost £2,000,000, but it is unlikely that the main works of construction will be put in hand until conditions are much more favourable. For the same reason the Leith Harbour Commissioners have not yet been able to make a commencement with any part of their big scheme of extensions. An attempt by the Commissioners to obtain State assistance for the reconstruction of the old fishing harbour at Newhaven within their jurisdiction, made early in the year, resulted in no help being forthcoming. The South-Western Railway Company has not yet commenced the works proposed on the east side of Southampton Water at Woolston, but the Southampton Harbour Board, with assistance from the railway company, proposes immediately further to deepen the approaches to the docks to meet the needs of the largest White Star and Cunard liners. The railway company, it is stated, has recently made an offer for the purchase of the 45,000-ton Hamburg floating dock which arrived in England during the year as part of the

Scapa Flow incident reparation. The company proposes to station the dock at Southampton. At Swansea the construction of a large graving dock is proposed. The River Wear Commissioners are applying to Parliament this year for powers to close the old south outlet to the harbour of Sunderland. The Poole Harbour Commissioners also are seeking powers to construct a training bank at the mouth of the harbour. The Bill to secure powers for the construction of wharves, &c., in Dartmouth Harbour, promoted in the last session of Parliament, was dropped.

At Ipswich nothing was done during the year to carry into effect the powers obtained by the Harbour Trustees under their Acts of 1913 and 1918. The Portsmouth Corporation proposes to improve the Camber and other parts of the commercial harbour, but no definite scheme appears to have been approved. At Cowes the local Harbour Authority has been in conflict with trading interests, which wish to provide much-needed wharf accommodation in the river Medina. As a result of this difference of opinion the carrying out of the work has been postponed. At the same time the Harbour Commissioners are anxious to proceed with the construction of the reinforced concrete breakwater on the Shrape Bank to the east of the mouth of the Medina, for which they obtained powers over ten years ago, but lack of funds apparently prevent them from putting the work in hand.

Inland Waterways.

Mr. Neville Chamberlain's Committee on Inland Waterways, appointed in 1920 by the Ministry of Transport has not yet issued a final report. Two interim reports have, however, appeared; the second, issued in July, 1921, recommends the constitution of regional public trusts to take over and control several groups of waterways. In the first instance it is thought the river Trent and the waterways and canals in connection with it should be formed into one trust "at the earliest possible moment," but the Committee considers that action in regard to other areas should be deferred until the experiment in the case of the Trent area has been made and its results are apparent. At the same time it strongly recommends that the completion of the improvement of the Trent Navigation between Newark and Nottingham, to a standard which will permit fully loaded 120-ton barges to reach the latter place, should be proceeded with at a cost which it estimates will not exceed £500,000.

The report of the Committee so far affords no hope to advocates of the "Cross" improvements, recommended by the Royal Commission in 1909, of this great scheme being realised. The Nottingham Corporation, which in 1915 obtained parliamentary powers to carry out the Newark-Nottingham improvement by arrangement with the Trent Navigation Company, made a commencement with the works in the course of the autumn, mainly with the object of finding work for the unemployed and in anticipation of a substantial grant in aid which it hoped to obtain from Lord St. David's Unemployment Grants Committee. The work includes the construction of three new locks and two weirs, and, if completed, will undoubtedly be of great benefit to the trade of Nottingham and the district. At least three canal undertakings in England ceased to act as canal "carriers" in the course of the year as a consequence of the increase of wages and other expenses, and parliamentary sanction was obtained to the closing of several small canals and branches no longer used to an extent which justified their continued existence.

Aeronautics in 1921.

ALTHOUGH it cannot truthfully be said that the past year witnessed any marked signs of a revival in the aeronautical industry, it would be wrong to convey the impression that the position suffered a steady deterioration from the admittedly bad state in which the industry found itself at the end of the preceding year. Twelve months ago we had to record the closing down of several of the best known aircraft manufacturing works and the virtual abandonment by others of active production. The process by all the signs threatened to continue so as to leave but one or two firms in the business. Actually, however, somehow or other, the position was tided over, with the result that we can still count quite a respectable number of firms engaged in the manufacture of aeroplanes. The number may not have grown, but it has not perceptibly shrunk, while of those firms still included in the industry several have had the courage to reorganise their establishments and strengthen their staffs.

The reason for the more hopeful outlook in the industry is, we think, not far to seek. It certainly does not appear to us to lie in the extended scheme of subsidising civil aviation which the Government brought into force in June. That measure enabled the British companies operating the cross-Channel services to compete on even terms with their foreign rivals, and being more than a mere temporary expedient served to increase confidence in the financial side of the undertakings. Traffic certainly grew after the scheme came into being, but even so, the demand for commercial machines required to carry on such services as now exist, or as are at all likely to be started in the near future, would not justify anything like a dozen or more aircraft manufacturing firms keeping their works open and looking with something approaching confidence to the coming months.

Civil aviation as an outlet for the production of the factories is hardly, if at all, more important to-day than it was twelve months ago. The more hopeful tone in the industry arises, we believe, not from the prospects on the civil side, but from those on the military. We have from the first maintained that the latter would always remain the chief branch, and the history of the industry and science of aeronautics during the past year amply strengthens that view. As will presently be shown, the year witnessed the advent of one or two new designs of commercial machines, but on examination it will be found that these machines are in general rather in the nature of modifications of existing types than the first of new species. Speaking to a certain extent figuratively, it may be said that the designer of commercial machines concentrates his attention chiefly on the accommodation for the passengers or freight, and is more or less content with the power unit and flying organs as he finds them. In one respect only can civil aviation be given credit for any really important technical development apart from that of mere adjuncts, namely, in the revival of the monoplane. The Bristol, the de Havilland and the Handley Page companies have produced, or are producing, machines of this class, while Fokker monoplanes are being successfully employed on cross-Channel work. It may perhaps be remarked that the "revived" monoplane resembles its prototype of nine or ten years ago scarcely otherwise than in the number of its wings, the most outstanding difference being found in the manner in which these organs are now formed as cantilevers extending from the fuselage unsupported by external stays. How far it is just to ascribe even the revival of the monoplane to the civil side of aeronautics is open to some doubt. Certain it is that the most notable British example—the de Havilland—was produced in the first instance as an experimental machine for the Air Ministry, to be converted in the second machine for the carriage of passengers.

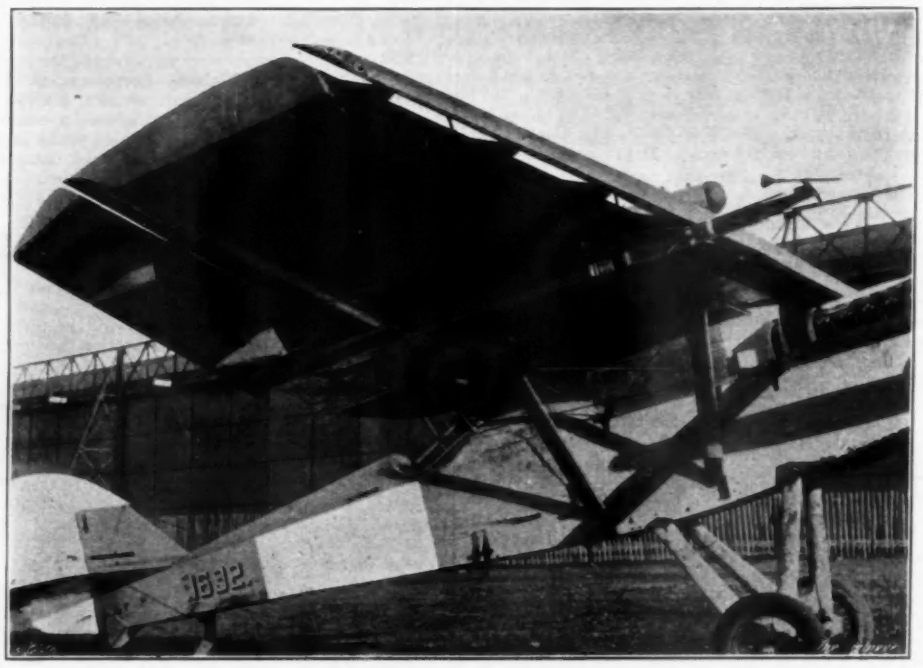
The real—practically the sole—impetus towards the technical development of the aeroplane is contributed to-day by the military side of aviation. The substitution of metal for wood in the structural parts, the development of new types of engine, the employment of high flash point fuels, the investigation of the steam turbine as an aeronautical prime mover, the possibilities of the helicopter and other equally important and radical departures from accepted ideas, are at present all in the hands of those whose first concern is with the progress of military aeronautics.

Just as in the matter of research and experiment, so too in the matter of actual construction, the military side of aviation is rapidly becoming the mainstay of the industry. Indeed, it cannot be denied that during the past twelve months the closing down of important aeronautical works, a process initiated on a threatening scale towards the end of the previous year, would have continued but for the Government work that was given out. Little may be published regarding the designs of the military machines that have been or are being so built, but sufficient is known to permit us to say that the Air Ministry is showing every sign of fostering progress and of taking advantage of the results of recent research, and is far from resting content with the best designs of the war period.

Some British Aeroplanes of the Year.

Following our usual custom, we will now deal with some of the principal designs of British aeroplanes produced during the past year. The record, it must be admitted, is not a lengthy one, very much less indeed than that which we had to report twelve months ago, and of the machines embodied in it, it cannot be said that any one is of outstanding novelty.

Westland Aircraft Works.—The aeronautical branch of Petter's works at Yeovil has not produced any later type of commercial machine than the six-seater limousine illustrated in our last annual review, with which it carried off first prize in the small class at the Air Ministry's competition of 1920. During the past twelve months, however, it has been engaged on the construction of a limited number of machines for the Air Ministry. An example of the type of machine produced is illustrated in our Supplement. This design, known as the Westland "Walrus," is intended for naval "spotting" purposes. It is equipped with a pair of small wheels and a special form of landing carriage to enable it to alight on the deck of an aeroplane carrier, and with the "Grain" type of flotation gear to keep the machine afloat in the event of a forced descent on the sea. The fuselage is of a peculiar form. The pilot's cockpit is situated far back in line with the rear edge of the wings. The position is no doubt a disadvantageous one from the point of view of observation, but



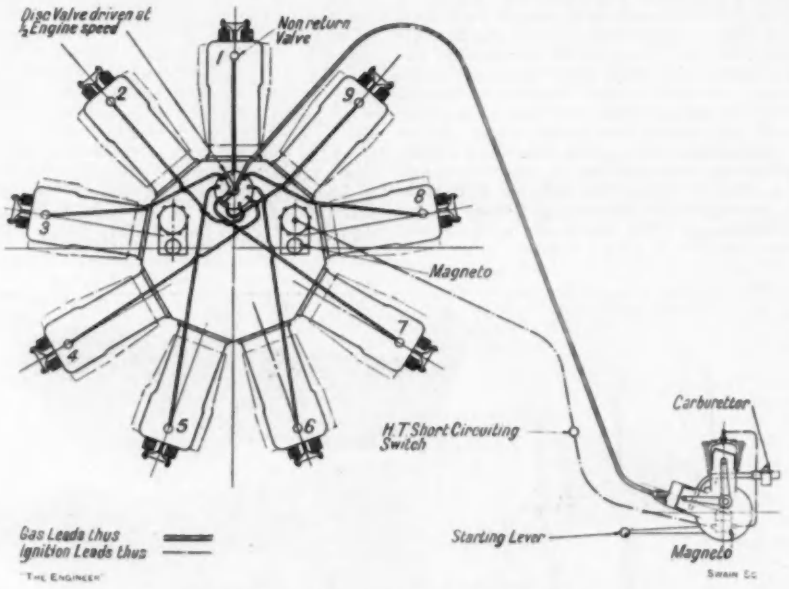
HANDLEY PAGE EXPERIMENTAL MONOPLANE WITH SLOTTED WINGS

criticism in this respect is rendered substantially void on the ground that the observational work is performed by an officer accommodated in a compartment behind the pilot and formed with a chamber—the hump on the underside of the fuselage—in which the observer may lie down and so obtain an uninterrupted view over a wide area of sea. Still farther back, almost at the tail, is a cockpit for the wireless operator. The observer, it will be gathered, acts as the gunner during a fight. The machine is fitted with detachable wings, which may be removed as complete cellules in a few minutes to facilitate storage on board the carrier. Its span is 45ft. 10in. and its overall length 30ft. 2in. The power unit is a Napier 450 horse-power "Lion" engine. Our engraving represents the first Walrus machine built by the Westland works. Many improvements, of which it is not permissible to give details, are now being introduced in the design.

Handley Page, Limited.—The well-known Cricklewood works of Handley Page have been kept in partial employment on the construction of a certain number of torpedo-carrying aeroplanes for the Government and of a few civil machines of the W 8 type. Of the former it is not permissible to publish details or illustrations, while of the W 8 design we gave particulars in our annual review two years ago. The civil machines are being constructed to the order of the Air Ministry, and are intended to be placed on the cross-Channel service in the spring. Under the terms of the Government's subsidy scheme, it may be recalled, an approved firm can hire a Government machine at a monthly rental of 2½ per cent. of the cost of building it and obtain full possession of the machine after paying thirty such monthly sums. In addition to

carrying out the above-mentioned constructional work, the Handley Page Company continued its research work on the slotted wing. This experimental work is being conducted partly in the firm's wind tunnel and partly on a full-scale size. For the latter purpose a D.H. 9a fuselage has been fitted with "high-lift" monoplane wings formed with a slot along the front edge and virtually with a second slot at the junction between the wings and the ailerons. A view of this experimental monoplane is reproduced herewith. The slotted wing is now being actively studied in England, the United States and Germany. This is not the place to enter into a discussion of its theory. Those who desire to study it can be referred with confidence to the paper which Mr. Page read before the Royal Aeronautical Society in February of the past year. The advantages of the slotted wing in reducing the horse-power for the same top speed, in lowering the landing speed, and in other directions are now well established. Many practical difficulties have, however, yet to be surmounted before full advantage may be taken in an actual machine of all the possibilities inherent in the idea. Thus it seems essential that the area through the slot or slots should be capable of adjustment, from zero upwards, by the pilot when the machine is in flight, and that the wing should be fully slotted and not formed with but one slot near the leading edge. Constructional reasons have told against these requirements being fully carried out. In the experimental monoplane illustrated in our engraving the opening and closing of the slot is controlled by means of a lever whereby the pilot is enabled to rotate the auxiliary plane. In the design of some complete machines now being undertaken an improved and simpler method of controlling the slot will be adopted. In the wind tunnel a model of the machine illustrated showed a maximum lift coefficient of 1.035 in absolute units when the wings were slotted and .77 when they were unslotted. The full-sized machine in actual test was capable of being landed at 43 miles an hour.

The Gloucestershire Aircraft Company, Limited.—This firm, an important manufacturer of aeroplanes for the Government during the war, strengthened its resources in the course of the year by acquiring the services, as chief engineer and designer, of Mr. H. P. Folland, late of the British Nieuport Company, and one of the best-known aircraft designers in the country. Very soon after Mr. Folland joined the staff at Cheltenham he undertook the design of a high-powered single-seater racing machine known as the Mars I. This remarkable machine, of which we give an illustration in our Supplement, was completed, and, piloted by Mr. J. H. James, won the Aerial Derby within six weeks of the date on which Mr. Folland began work on the plans. During December, at Martlesham Heath, the same machine, on an official speed trial, broke the world's record for average speed by flying at the rate of 196.6 miles per hour. The machine in several of its details resembles the Nieuport "Nighthawk" and similar later productions of Mr. Folland's old firm. It is equipped with a 450 horse-power Napier "Lion" engine, and has a total wing area of only 205 square feet, the span being 23ft. and the chord 4ft. 9in. It has a total weight of 2500 lb., and is equipped with fuel tanks for 50 gallons. Its chief general characteristic is its extremely clean lines. The engine, it will be noted, is practically completely enclosed within stream-line cowling, which is extended upwards to the top wing and backwards to the front edge of the cockpit. The stream-lining of the landing wheels is a small point worthy of notice. Three other Mars machines have been recently produced by the firm. Mars II. is a fast single-seater fighting scout having a ground-level speed of 127 miles an hour, a ceiling of 19,000ft., and a range of 300 miles. Mars III. is a very similar machine, arranged, however, as a two-seater with dual control, and intended for scout training purposes. The fourth design is an adaptation of the second for use from a ship. These three types of machine are all equipped with Bentley rotary 230 horse-power engines. Examples of them were supplied during the year to the Japanese Government.

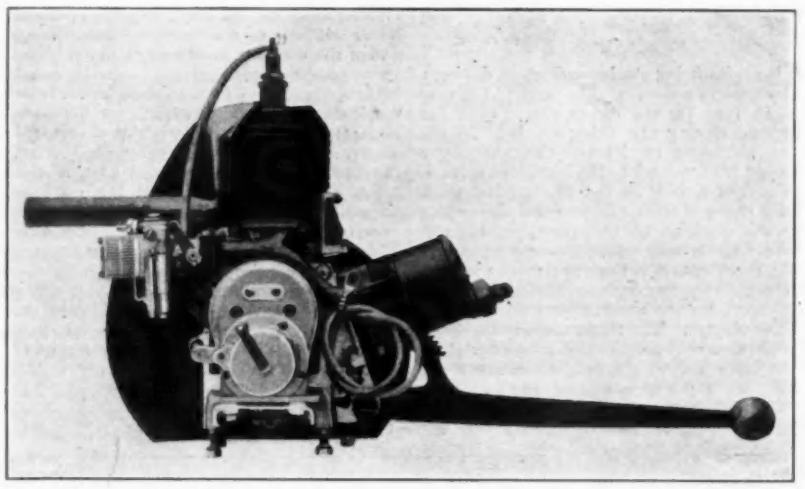


BRISTOL STARTER AND ENGINE CONNECTIONS

S. E. Saunders, Limited.—The amphibian flying boat Kittiwake, with its many unusual and interesting features, produced by Messrs. Saunders, of East Cowes, was mentioned and illustrated in our previous annual review. This year we are only permitted to say that during the past twelve months the firm was engaged on the production of "Valentia" seaplanes for the Air Ministry. It is not permissible to publish particulars of these machines, but it is understood that they are of large size and are driven by two Rol's-Royce Condor engines, each of 600 horse-power.

William Beardmore and Co., Limited.—This firm was prominent in the aeronautical world during the past year by virtue of the completion at its Inchinnan works of the airship R 36, a Government vessel begun for war purposes, but finished as a passenger carrier. As regards the construction of aeroplanes, it has, so far as we can determine, done nothing.

Boulton and Paul, Limited.—We are informed that at the Norwich works of this firm the development of all-steel construction is still being investigated, and that at an early date several important results are to be expected. So far as actual construction is concerned, the work undertaken was solely for the Government. Of the machines produced, little may be said. One of them, however, a three-seater long-distance reconnaissance biplane, fitted with two Napier "Lion" engines, is illustrated in the Supplement. The makers tell us that this machine is unquestionably the fastest twin-engined biplane so far built.



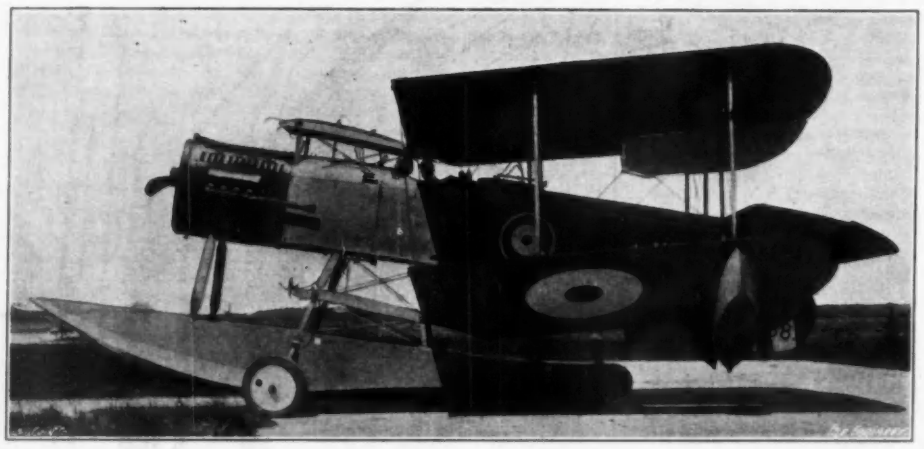
THE BRISTOL GAS STARTER FOR AERO AND OTHER ENGINES

FLOATATION BAGS ON "PANTHER" MACHINE

PARNALL "PANTHER" WITH BODY FOLDED FOR STOWAGE

The de Havilland Aircraft Company, Limited.—One of the most interesting machines completed during the year was the de Havilland No. 29 monoplane, of which we give an illustration in the Supplement. This machine is of the cantilever wing type, that is to say, the wings are made with increased section and so

stayed internally as to enable external stay wires to be dispensed with. Designed as an experimental machine for the Air Ministry, it was reconstructed, in the second example produced, as a commercial aeroplane, and as such is provided with a cabin with seats for ten passengers. The pilot and the engineer or navigator sit side by side in a cockpit in front of the leading edge of the wings. The engine is a 450 horse-power Napier "Lion," and is so mounted that it can be readily detached from the nose of the machine as a complete unit merely by undoing four bolts and disconnecting the fuel pipes. The main petrol tanks form part of the wings and are shaped to the profile of the leading edge. For its carrying capacity the machine has a relatively small wing area, namely, 440 square feet, but it is to be borne in mind that the thick wing section gives a high lift coefficient. The wings are covered with fabric, but the fuselage skin is made of plywood. Particulars of the performance of the machine on test are not available, but it may be said that its total loaded weight in working order is in the neighbourhood of 7500 lb. It is of interest to note that Captain de Havilland is by no means committed to the monoplane type, but that in two new machines for commercial purposes now being constructed, the D.H. 32 and the D.H. 34, he has returned to the biplane arrangement.



PARNALL "PUFFIN" WITH WINGS FOLDED

The Central Aircraft Company.—This company has, we gather, produced no new design of machine during the year, but concentrated its attention upon the types referred to in our review for 1920.

The Bristol Aeroplane Company, Limited.—Research and experimental work was continued during the year by the Bristol Company in connection with the development of various types of aircraft. In addition, a very interesting new machine was produced, namely, the ten-seater biplane which we described in our issue of July 15th, 1921. This machine—illustrated in the Supplement—is equipped to carry eight passengers in an enclosed cabin, and a pilot and mechanic in an open cockpit at the forward end of the cabin. It is driven either by a 400 horse-power Bristol "Jupiter" air-cooled engine or a 450 horse-power Napier "Lion," the power plant in both cases being arranged for quick detachment in order to facilitate access to the rearward side without the removal of any portion of the cowling. The cabin is fitted with collapsible seats, which, when folded, leave a large floor space for the carriage of cargo. One hundred gallons of petrol are carried in two main tanks slung beneath the bottom planes, the fuel being drawn therefrom by a centrifugal pump and delivered to the carburetters, and any surplus being passed to a 10-gallon gravity tank having an overflow to the main tank. A steel fireproof bulkhead extends across the fuselage behind the engine, and no petrol is carried in the body aft of this bulkhead. The pilot's cockpit is equipped with complete wireless telephonic and telegraphic installations. The machine is, we understand, likely to make its appearance on the air routes in the spring of this year.

In addition to prosecuting development work in connection with aircraft, the Bristol Company during the year continued to devote close attention to the matter of aero-engines. It will be recalled that the company in the previous year acquired the rights of the Cosmos Engineering Company in its designs of static radial air-cooled aero-engines. Of these designs that known as the "Jupiter" has so far received principal notice. This engine in the course of the year was submitted to the British Air Ministry Type Test in accordance with the schedule of March, 1920, and, as recorded in our issue of November 11th, in which we summarised the results of the test, ably fulfilled the stringent requirements laid down in the schedule. It is of interest to note that although the normal horse-power of this engine is in the neighbourhood of 380, it was submitted after a 50-hours' endurance test at normal output to an hour's run at full throttle, and that in this condition, running at 1840 revolutions, it developed 450 brake horse-power.

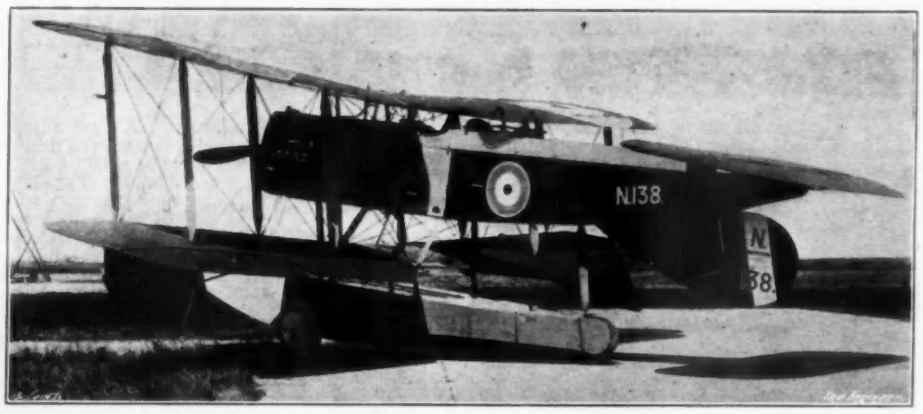
As the horse-power of aero-engines increases the operation of starting them by the usual method of swinging the propeller becomes less satisfactory and safe. Self-starters of the motor car type have been applied to aero-engines, but in the starter produced during the year by the Bristol Company we have something of an interesting new design. This appliance, illustrated herewith, consists of a small two-stroke single-cylinder petrol engine, complete with its carburetter, magneto and starting handle, and formed with a small pump cylinder and piston driven off its crank shaft. The pump cylinder draws combustible mixture from the starting engine carburetter and delivers it under pressure through a small disc valve distributor to the main engine cylinders. The distributor is driven at half speed by the main engine, and is set to supply mixture to the cylinders during the time when each piston is on its firing stroke and again during a portion of the induction stroke. The main pistons are thus moved at first by the direct pressure of the mixture supplied during the firing stroke. In the course of the induction stroke the mixture passes through the open inlet valve into the induction system. Thus at the end of a very short time the induction system is fully charged with mixture and the engine is turning slowly at about 15 revolutions per minute. A switch connecting the magneto of the starting engine to that of the main engine is then operated, with the result that the gas supplied by the starter is fired in the main cylinders by the current derived from the magneto of the starter. The main engine thereafter picks up on its own carburetter and magneto. The starter, we are informed, weighs only 40 lb. complete, and can maintain a gas pressure of 140 lb. It is capable of starting aero and other engines up to 500 horse-power in size. In addition to its use as a starter, it can subsequently be employed to drive auxiliaries, such as a wireless set. The starter cylinders are of cast iron, while the pistons, of 3in. diameter and 2½in. stroke, are of aluminium. A cast iron fly-wheel with fan blades and a vee groove for a belt is fitted to the crank shaft.

Short Brothers, Limited.—Little fresh information is available regarding Messrs. Short's all-metal biplane "Silver Streak," exhibited at the Olympia Aero Show of 1920 and fully described at the time in our pages. The machine, as we recorded a year ago, was acquired by the Air Ministry for experimental purposes. It proved, we are informed, thoroughly successful in the air, and stood up in a completely satisfactory manner to very severe constructional tests to which it was subjected at Farnborough. Details of these tests are not, however, obtainable for publication.

The Blackburn Aeroplane and Motor Company, Limited.—The new types of machine built by the Blackburn Company during the year were constructed to the order of the Air Ministry and cannot be described. In addition, the firm supplied machines to the American and Japanese Governments. It may be recalled that this firm has made a speciality of the torpedo-carrying aeroplane, and that its "Swift" type of machine designed for this purpose was illustrated and described in our review for 1920.

Vickers Limited.—No new type of aeroplane, so far as we can gather, was produced during the year at the Weybridge works. The "Vickers-Vimy" twin-engined machine and the "Viking" amphibian flying boat were, however, developed in certain respects. The former, as is well known, was in the first instance adapted for commercial purposes, and then was modified to serve as an ambulance machine. It has now, we learn unofficially, been enlarged somewhat for the purpose of transporting troops. The amphibian flying boat also suffered a process of enlargement, and in its latest form is capable of carrying six passengers and a pilot. It is now made in three patterns, namely, as a deck-landing fleet spotter with folding wings, as a general service machine fitted with bomb racks and two Lewis guns, and as a commercial machine for the carriage of passengers or goods.

George Parnall and Co.—The machines produced by George Parnall and Co., of Bristol, have from the first been of highly original design, and concerning them little information until quite recently has been permitted by the Government to be published. Thus one of the firm's earliest machines, the Parnall "Panther," although it was produced during the war, remained a closely guarded secret until the summer of 1921, while of a later design, the Parnall "Puffin," little more than a photograph is available. The "Panther" machine is illustrated in the accompanying engravings. It was specially designed for use with the Fleet and for landing on the deck of and for stowage within an aircraft carrier. Its chief constructional characteristic is its folding body, an arrangement for reducing stowage space adopted as an alternative to the usual folding wings. The tail end of the fuselage, it will be gathered from one of the views of the machine given herewith can be hinged back against the wings, the rudder and elevator controls being arranged in such a way as to permit this folding action to take place without their requiring to be disconnected. For emergency descent on the sea, the undercarriage is equipped with a hydrovane in front, while on each side of the carriage struts a floatation bag is carried. When not required, these bags, in order to reduce wind resistance, are carried folded within casings, occupying a small space. They may be quickly released and inflated—as shown in a view reproduced herewith—by the pilot, and provide sufficient buoyancy to support the machine on the sea in the event of a forced descent. The inflation of the bags is effected by means of a supply of compressed air carried in the cockpit. The machine is a two-seater, the observer sitting in front while the pilot sits in a separate cockpit, which he enters through a hole in the upper wing. The wide range of speed possessed by the machine—from 105 to 40 knots—is an important point in its favour as a deck-landing aeroplane. It must be admitted that a machine such as the "Panther," intended to operate with the Fleet, which can alight on and rise from the deck of a ship, but which cannot as a matter of routine do likewise on or from the surface of the sea, is a trifle illogical. The Parnall "Puffin" illustrated herewith is therefore the next natural step in the evolution of the ideal Fleet "spotter," for it is a deck-landing amphibian. It is equipped with a central stepped float, to which a pair of retractable landing wheels is fitted. The rear end of the float, we understand, is hinged to fold upwards, and by means of a spring strut extending from its upper surface to a point on the under surface of the fuselage, serves



PARNALL "PUFFIN" DECK LANDING AMPHIBIAN MACHINE

presumably as a tail skid when the machine is alighting on a ship's deck or on land. Another special feature of interest lies in the fact that the rudder and tail fin are situated below the level of the elevators and fixed tail planes, so as to afford the gunner in the after cockpit an unrestricted arc of fire rearwards.

Airships.

The year cannot be described otherwise than as a most dismal one for the airship. At one time it looked likely that the craft of this description owned by this country would be at least given a chance to demonstrate their commercial capabilities. One vessel, the R 36, built at Inchinnan, was completed at the Government's expense as a passenger carrier, and every effort was made to induce private enterprise to take over it and its fellows for operation on a commercial basis. At Pulham the experiments with the mooring mast proved that a practicable solution to the difficult problem of landing and anchoring an airship had been found, and as a result of the experience gained an improved design of mast was erected at Croydon in anticipation of the requirements of a commercial service. Still, however, private enterprise hung back, even although the Government offered to make a free gift of the airships and a considerable amount of associated equipment and plant to any responsible British company that would undertake to operate the vessels commercially. Failing in this direction, various schemes were explored, under which the vessels might be run for civil purposes with the Government as partner, and, finally, at the Conference of Empire Premiers in the summer it was proposed to initiate certain experimental Empire airship services by the direct co-operation of the Home and Dominion Governments. After months of discussion, all the schemes were for the time being brought to a sudden and dramatic conclusion by the lamentable disaster to the R 38, over Hull, on the afternoon of August 24th. That vessel was not included among those for disposal for civil use, but had been completed for sale to the United States Navy. Carrying a mixed British and American crew, totalling forty-nine, it was being subjected to its final trial before setting out to fly across the Atlantic. While making a sharp turn at high speed, it suddenly broke in the middle, exploded and fell in flames into the Humber, carrying to their deaths all but five of those on board. The vessel, as we have said, was not intended for civil purposes. It was in many respects of an experimental design —daringly experimental, according to some. Nevertheless, the disaster wrecked more than the airship involved in it. It was at once seen to be hopeless to proceed farther with the organisation of a commercial airship service. The vessels—or such of them as had not suffered accident during the long period of the preliminary discussions—were dismantled and their parts put into store.

From the set-back thus experienced, the airship will undoubtedly take a long time to recover. It is true that efforts to continue its development are being made abroad, for example, in the United States, the Navy Department of which country was conducting experiments towards the end of the year into the practicability of using helium or a helium mixture as a substitute for hydrogen. It is likewise true that even in this country there yet lingers in some quarters a desire to see the airship given one more chance, and that there are those who would still seek to convince us that its operation on a commercial basis is financially justifiable. There is, however, very little impetus now remaining behind the technical development of the airship, and without wishing to pose as prophets, we do not anticipate that any further serious work with or on airships will be undertaken, in this country at all events, until such time as scientific research shall have placed at our command new materials, new methods of construction, and new principles of design.

Railways in 1921.

THE story of the engineering work of the railways of the United Kingdom during the past year is a tale soon told. Even although, in accordance with past practice, we may review other events than engineering there is little to be said.

The Railways Act.

What, but for the coal dispute of April, May and June, would have appeared as an epoch in railway history, was the passage of the Railways Act which received the Royal Assent on August 19th. The control of the railways by the Government had already come to an end at midnight on the preceding Monday, August 15th, when the two-year period sanctioned by the Ministry of Transport Act, 1919, expired. Coupled with the relief that came from this knowledge there remained the fact that the new Act allowed amalgamations without further parliamentary powers, provided they were in accordance with a scheme laid down in the Act and met with the approval of a Railway Amalgamation Tribunal to be set up; it voted the companies sixty millions in settlement of their claims under control; it set up a Rates Tribunal which, whilst mainly intended for the protection of the trader, will be a benefit to the railways; it laid down that the rates to be fixed were to be such as would, so far as practicable, yield, with efficient and economical working and management, an annual net revenue equal to that of 1913—and more where new sources of revenue had been provided since then; and it incorporated an agreement arrived at between the companies and the men whereby the latter abandoned a scheme of Sir Eric Geddes for them to be represented on the boards of directors. None of these things have, however, aroused, as yet, much enthusiasm among the companies. They have comparatively little traffic to be concerned over. The remarkably fine summer led to little household coal being carried, and owing to bad trade a reduced quantity of industrial coal was transported. General merchandise was affected by bad trade, too, and commercial motor vehicles took the cream of the short-distance traffic. Reductions were made in passenger rates, but no charge to-day is less than a single fare for the double journey and thus one pays 9s. for a trip which in pre-war times cost 3s., and 12s. for what was 5s.

New Works.

It will come as no surprise after the foregoing recital to hear that very little new work was done during the past year. The uncertainty as to the future that prevailed during control kept the companies from embarking on any new schemes and since, eighteen months ago, the grouping of the companies became the policy of the Government, and of the railways, the latter are holding their hands; partly to see what works are really necessary when the amalgamations are complete, and partly to allow the expenses to be spread among the consolidated companies. Added to all these retarding influences was the general uncertainty of trade. The report generally received from the various chief engineers has been that no new works or large renewals were carried out during the period under review. There are, however, exceptions, and among these are the following:—

London and North-Western.

Attention has been mainly concentrated on the completion of the Chalk Farm Widening. Some of the lines, including the up main, are now in their permanent position, and it is hoped to complete the work during the coming summer.

Great Western.

This company has in hand deviations, on both the Kingswear and Falmouth branches, which will result in the disappearance of four more of the old wooden viaducts of Devon and Cornwall, each being replaced by a solid embankment. The Falmouth branch deviation also necessitates the remodelling of Penryn Station. An embankment and sea wall have been constructed on the site of the old viaduct giving access to Penzance Station, and a double line provided in lieu of the single line formerly existing over it.

The doubling between St. Dennis Junction and Tregoss Moor was practically completed in 1914, but, owing to the outbreak of war, was not brought into use, and, subsequently, the permanent way materials were sent overseas for military purposes. The restoration of this double line—139 chains in length—has now been carried out. The permanent way materials in the up main line between Haverfordwest and Johnston—3 miles 20 chains in length—which were also taken up and sent abroad during the war have been relaid and the double line opened for traffic. Extensive marshalling siding and mileage yard accommodation have been provided at Margam Junction and Llanelly, and, at the latter place, a "hump" yard was constructed. It is expected that similar accommodation now being proceeded with at Kingswinford Junction will soon be ready for traffic.

Towards the end of the year a contract was let for widening two bridges and the viaduct over the river Usk at Newport, and preparations are being made to put in hand the completion of a further portion of the Clydach, Pontardawe and Cwmgorse Railway, which was stopped during the war by order of the Ministry of Munitions. Tenders for this work will probably be invited early in the present year.

North-Eastern.

Work during the past year was concentrated on the construction and equipment of shops for dealing with the building of wagons at Darlington; the building of electric car sheds at South Gosforth for the Tyneside lines and the construction of a curve, 24 chains in length, to join the Dunston extension railway with the Gateshead, Norwood and Blaydon branch. The last includes a bridge over a public road.

London and South-Western.

The only works in connection with the reconstruction of Waterloo station remaining to be completed are the office buildings and the roof over the concourse. It is hoped to finish them early this year. At the Feltham gravitation shunting yard, described in our annual article a year ago, the up and down "humps," reception and marshalling sidings and the wagon repair shop and cattle dock were brought into use.

Great Central.

A contract has just been placed for reconstructing a timber viaduct carrying the railway over a navigable creek. The new bridge, which will take a double line of way, will be constructed partly in reinforced concrete, supported on reinforced concrete piles, with the centre span over the navigable portion of the creek in steel.

At Keadby, where the main line between Doncaster, Immingham and Grimsby crosses the river Trent by means of the Scherzer rolling lift bridge, which was opened in 1916, the old structure, which was built in 1860 and consisted of an iron viaduct about 500ft. long with four fixed spans of about 70ft. each and a swing span with two openings of 60ft. each, was, during the year, completely removed from the river. The bridge was supported on cast iron cylinders, there being fifteen in all, and these have been removed to a considerable depth below low-water level, and in addition a very large number of timber piles, which formed the dolphins around the old piers, have also had to be drawn. The river traffic through the new bridge is considerably facilitated now that the old one, which was in close proximity, has been taken away.

Work progressed throughout the year in connection with the reconstruction of a portion of the old Timber Market on the west side of No. 1 Fish Dock at Grimsby; this work is being carried out in reinforced concrete, and overhead offices and a box loft are provided above the market floor. The length of market under reconstruction is about 270ft. In addition, work is in progress in connection with the reconstruction of the entrance to No. 1 graving dock, which opens out into the Royal Dock at Grimsby. A new pump house and pumping plant are being installed in connection with the graving dock.

A reinforced concrete tank holding 50,000 gallons, 30ft. in diameter, 12ft. deep and 40ft. above the ground, supported on reinforced concrete columns, was erected at Barnetby station, where a large number of engines are watered, and at Melton Ross, about 2 miles east of the station, where a bore was sunk some years ago into the chalk, a new pump house and pumping plant were installed.

Metropolitan District, and London Electric Railways.

The erection of a new central overhaul shop was begun at Acton Town. New exit stairs at the west end of Victoria station for each platform were completed. They allow for a much quicker clearance of the platforms in the rush hours. Oil buffer stops have been provided at Mansion House and Acton Town stations. Automatic signalling was installed between Euston and Stockwell on the City and South London Railway.

Caledonian Railway.

The bridge carrying the Airdrie branch over the main line at Whifflet has been renewed. It has four spans ranging from 36ft. to 98ft., the total length being 284ft. The width between the outside girders is 54ft. 3in., and the total weight of the steel work is about 450 tons.

North British Railway.

As stated a year ago, the new up goods loop which forms part of the scheme for a new station at Berwick was opened in 1916. The second stage in this scheme was the reconstruction and enlargement of the bridge carrying the Castlegorton-road over the railway. This work was finished in August last. The lengthening of the platforms from 340ft. to 600ft. at Dunfermline Upper Station, together with the reconstruction of the station buildings and the construction of a new verandah and overbridge, were completed. The erection of a new viaduct, with three spans, each of 57ft. 7in. width, supported on brick piers carried down to the solid rock, by the side of the existing structure at Dunninald on the main line between Arbroath and Montrose, has made such progress that the superstructure is now under erection and the bridge will be opened for traffic early in 1922.

Liverpool Overhead and Mersey Railways.

The first railway named above was, during the year, re-signalled throughout with daylight colour lamp signals, controlled by track circuits and provided with automatic train stops. The Liverpool Central–St. James–Hamilton Square section, including the portion under the river, of the latter has been automatically signalled.

New Proposals.

The North Staffordshire Railway Company obtained powers during the year to build a new railway at Stoke-on-Trent, which will improve the approach to and departure from that station for the Crewe, Macclesfield, Loop Line and Market Drayton trains. The North-Eastern secured an Act for a few short new lines and widenings. Powers under a late Bill were given the London and North-Western to deepen the inner harbour at Holyhead.

At Easter, before the Railways Bill had been intro-

duced, it was announced that the Lancashire and Yorkshire Railway Company was to be amalgamated with the London and North-Western Railway Company. This was in accordance with the grouping scheme, and Section 8 of the Act allowed the scheme to proceed. The preliminaries were sanctioned by the proprietors on November 17th, and came before the Railway Amalgamation Tribunal for formal approval on December 20th. They came into force on January 1st, 1922.

In April, also before the Railways Bill was introduced, an intimation was given that the Great Western had absorbed the Port Talbot Railway and Dock Company. No further announcement hereon has since been made.

Accidents.

There were during the twelve months three accidents to trains in which passengers were killed. On January 26th a down local train was allowed to enter the single-line section between Abermule and Newtown, on the Cambrian, whilst an up express was in the section. In the consequent collision fourteen passengers were killed. The accident was due to the driver of the local train having been handed and having accepted in error a token for the section he had just left—the Montgomery-Abermule. On March 19th some empty carriages followed a passenger train out of the bay line at Airdrie, North British Railway, and when the train stopped at Coatdyke a collision occurred in which a passenger was killed. A Midland local passenger train for Derby was standing in New-street Station, Birmingham, on November 26th, when it was run into by a Midland express from Bristol. Three passengers were killed. The driver of the express was entering the station with care, but as there is a bad running view from his—the right on the Midland—side of the footplate he relied on his fireman to tell him how the platform signal was. The latter said "On," but the driver thought he said "Off."

Mention must also be made of the explosion at Buxton on November 11th, when a boiler of a London and North-Western 0-8-0 mineral engine exploded just as the driver gave the engine steam on joining his train. The cause is still the subject of a Ministry of Transport inquiry.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

THE PANAMA CANAL SLIDES.

SIR,—In the issue of December 30th your correspondent, "D. M. M.," asks me to clear up the statement I made in my article on "The Problems of the Panama Canal Slides," that the mechanics of these slides were "reducible to identity with a soluble mathematical problem in capillarity."

I admit that this is a very brief summary—too brief indeed—of a very important geodynamical paper by the late Dr. Becker, one of the most distinguished geologists of the United States Geological Survey. But Dr. Becker's paper is very mathematical, and I was unwilling to give a detailed abstract of it and so introduce theoretical matter into an article which professed to give a description of the investigations that have recently been made and the work that has been done by practical men in dealing with the Panama Canal slides. The short abstract I did give purposely left out all the mathematical analysis.

Dr. Becker's papers were never popular when they dealt with his favourite science of "rock mechanics," because they were clothed in somewhat obstruse mathematical form and were often read with difficulty by his fellow-geologists. Dr. Becker was so convinced of the importance of the study of geodynamics, the investigation of the stresses and strains in deep-seated rocks, that he often used to say in conversation with his geological friends of the United States Survey that the study of the interior of the earth was the only thing really worth while. In his well-known monograph on the "Finite Homogeneous Strain Flow and Rupture of Igneous Rocks" he made a splendid attempt to define and formulate in precise terms some of the relations in the science of rock mechanics (geophysics).

To many excellent practical engineers the use of mathematical analysis in the study of the strains which take place in the interior of deep-seated rocks subjected to various stresses is more or less a mystery, while to the theoretical student of the mathematical treatment of capillarity or elasticity it seems to be an affair of certain mysterious differential equations, by means of which, as if by a kind of hocus-pocus, certain well-known results can be obtained. Kelvin, who, like Laplace, valued mathematical analysis, not so much for the mental gymnastics it involved, as for the means it afforded of solving physical problems, used to deplore the fact that so many minds of his day which were fitted for higher things devoted themselves to the mere mechanical process of working through mathematical expressions. In his younger days Kelvin had undertaken a mathematical investigation of the magnetic field and he used to say to his pupils at Glasgow University that Faraday, although he did not claim to be a mathematician, had yet a better mathematical conception of the "lines of force" in that field than many pure mathematicians had.

And so it may be with those stresses and strains in the rocks at the bottom of the Gaillard Cut. Mathematical analysis does not necessarily enable us to visualise them any better in the mind's eye.

In his mathematical analysis of the subject of slides Dr. Becker simplifies the mechanical problem as much as possible and supposes the case of a level plain underlain to a great depth by an ideally homogeneous rock. At any depth in this rock the pressure will be hydrostatic and equal to the depth multiplied by the density. He shows that there is a limit to the depth of a vertical cut in such a homogeneous isotropic mass. This limit is that at which the pressure is sufficient to produce simple shear in the mass, and he considers that $6\sqrt{2}$, or approximately $8\frac{1}{2}$, multiplied by the resistance to such shear, is about equal to the ultimate strength under linear compression.

The depth at which one-sided relief of pressure will produce simple shear he calls y_1, and he shows that in such a bank the profile of a surface along which the mass is strained to the elastic limit must be in the form of the elastic curve, the direction of which lies at a depth y_1. The most general equation of these elastic curves is $R\,y = b^2$, where R is the radius of curvature $(d\,s/d\,\psi)$ and b is a constant characteristic of the material and depending only on its density and tenacity, and being essentially positive, it occurs in the equation raised to the second power.

The lowest or basal slide curve is one which intersects the horizontal bank at right angles. Dr. Becker works out examples for this case and for other cases in which the bank is cut at acute angles.

In conclusion, Dr. Becker points out that a complete hydrostatic analogy exists between the form of these elastic curves and those which the surface of water assumes when it rises by capillarity between vertical parallel glass plates. The geometry of these curves has been known for over a century, and it was for this reason that I stated that the mechanics of the slides were reducible to identity with a soluble mathematical problem in capillarity, or, I might have added, elasticity.

This reply to the first of the queries of your correspondent, "D. M. M.," has already extended further than I intended when I started to explain, and, with your permission, I will answer his second query in your next issue, unless one of your readers has already done so. JOHN STUART.

London, January 2nd.

BOILER ECONOMY.

SIR,—During the holidays I have been reading Mr. Brownlie's paper and the discussion in the "Proceedings" of the Institution of Mechanical Engineers, and it has made me very sad. On pages 327–8 of Vol. No. 4, 1920, some particulars are given of the Lancashire and Yorkshire power station boilers, in which it is stated that each boiler utilises 1029.25 B.T.U. for each pound of water evaporated, or, say, 82.5 per cent. of the total heat in the coal of 12,762 B.T.U.; the economiser utilises 144.19 B.T.U., or, say, 11.5 per cent. The late lamented Mr. S. Weller told us the boy's view of the matter when he finished learning the alphabet, viz., was it worth while going through so much to learn so little. Would it not have been much cheaper to have increased the length of the boilers by, say, 4ft.—though perhaps boilermakers might heve a delicacy about this—or to put in one extra boiler, all the boilers having shortened grates and the nine burning the same total amount of coal at the same rate per square foot? Would not buildings and capital both have been saved?

An economiser with 7200 square feet of surface has many joints and only raised the feed temperature 143.6 deg. Fah. They are known to blow up badly. I lately saw some photographs of such a disaster where many lives were lost and the whole place was wrecked. They require a most wasteful (small) engine to drive the scrapers; but, in addition to this, they have a most endearing habit of reducing the chimney draught to a very appreciable extent. Can they or their makers justify their existence under such circumstances? "Oh, what a tangled web we weave, When first we practice to deceive"—Q.E.D.

London, January 2nd. NICODEMUS.

LOCOMOTIVES WITH FOUR EXCENTRICS.

SIR,—With reference to Mr. Jas. Dunlop's letters on this subject, will he be good enough to say on what information he bases his statement that Allan, on his return from Ireland, re-built the Swiftsure as a six-wheeled engine with Carmichael's valve gear? An 1840 list of Liverpool and Manchester locomotives, published on page 194 of Vol. 51 of THE ENGINEER, indicates that it was on four wheels at that date.

In Mr. Dunlop's first letter he gives a description of Wilson's engine used on the Stockton and Darlington Railway in 1826, said by Colburn to have had four cylinders. It has hitherto been supposed that no evidence whatever exists as to the actual construction of this engine, but if Mr. Dunlop has discovered some particulars of it, locomotive historians would be glad to know the source of the information. It is feared, however, that this design, like that of Messrs. Stretton and Pangbourne some twenty years ago, is purely imaginary. With regard to the remarkable separate cut-off valves fitted to the Lancashire Witch and Darlington engine of 1828–9, it appears from the original drawings that such valves were also fitted to the Twin Sisters and other engines designed in 1828.

The Darlington engine drawing is in the South Kensington Museum, but that of the Lancashire Witch is at Darlington.

E. A. FORWARD.

Wembley, January 3rd.

SIR,—It seems that Mr. Dunlop has missed one of the principal points in my letter in THE ENGINEER of December 23rd. It was on the authority of a letter from Mr. Alexander Allan himself, which I have in my possession, that I threw doubt on the illustration of the Swiftsure in D. K. Clarke's book. In this letter Mr. Allan stated that this illustration is "far from accurate," and that the form of crosshead shown with two slide bars was designed and brought out by Mr. Allan himself only in 1840. Accepting these statements to be correct, then the illustration cannot represent the rebuilt Swiftsure, but may possibly refer to another and later engine.

My previous letter dealt with the unsatisfactory evidence as to the date of the valve gear, and to this I cannot add anything further. E. L. AHRONS.

January 2nd.

A QUESTION AT THE CIVILS' EXAMINATION.

SIR,—On reading the question quoted by your correspondent, Mr. Conrad Gribble, it is obvious that it is a simple question purposely "wrapped up" by the examiners. My solution is explained as follows:—

The original beam of length L has a uniformly distributed load. Due to this load, there is a certain moment of resistance acting at the middle of the beam. The two smaller beams, "each of half its length," are supported at the ends and at the middle of the first beam. The same distributed load is applied to these two beams; therefore there must be an equal moment of resistance at the middle—that is, at the point where the two small beams are separated. This is supplied by the beam underneath, which actually offered this resistance in the first case; therefore the two smaller beams are acting as one beam, *i.e.*, as if they were joined together and had a total length L. Thus the bending moment diagrams are the same in every respect.

Regarding the second question referred to in your issue of December 16th, this is not a "catch," but simply recognition of the fact that the centre of gravity of the bar is vertically under the point of support and is surely elementary mechanics. I have had personal experience of this examination and am perfectly sure that the Institution would not set such things as "catches." Certainly, some questions are "wrapped up;" but, after all, for what purpose is an examination set? 1917.

December 20th, 1921.

ELECTRIC LOCOMOTIVE FOR THE NORTH-EASTERN RAILWAY.

SIR,—With reference to the design of the electric locomotive for the North-Eastern Railway, published in this week's issue, we notice that the compressors are described as being "Reavell's compressors."

We beg leave to say that these compressors were supplied by us, the designs having been produced in conjunction with Messrs. Reavell and Co., who built them under an arrangement with us.

THE BRITISH AIR BRAKE COMPANY, LIMITED,
J. W. CROSS,
Managing Director.

London, December 31st, 1921.

ELECTRIFICATION SCHEMES IN CZECHO SLOVAKIA.

AT the date of the establishment of the republic in October, 1918, Czecho-Slovakia, according to the *Gazette de Prague*, possessed thirty-eight power stations, with a total capacity of 120,000 kilowatts, while the length of transmission lines was some 1375 miles. To-day the capacity has increased to 200,000 kilowatts, while the length of transmission line has been extended to 3250 miles.

The existing power stations, however, are very far from being able to meet the demands throughout the whole country for electric energy, and the Government has in hand a far-reaching scheme of electrification, with the object of utilising to the full the considerable resources of water power possessed by the country and of cheapening the cost of electric power. So far the State has secured potential hydraulic energy to the extent of 150,000 horse-power, but it is expected that it will be possible to reach a total of 1,500,000 horse-power.

In the Government's electrification scheme the entire republic is divided up into fifteen districts, in each of which a main power station is to be set up. These main stations will be the property of the companies in which public bodies—the State, the county and local authorities—will participate to the extent of 60 per cent. of the total capital, the remaining 40 per cent. being subscribed by private shareholders, who will, of course, be found among the ranks of the consumers. The amount of capital so far invested in such companies is 300,000,000 crowns, and it is steadily growing. The companies enjoy certain privileges by law, notably the right of compulsory purchase of property essential for their undertaking, and the right of using railway, highway and canal lands, whether under State or private control. They are also granted certain relief in respect of taxation.

These companies will erect power stations, construct transmission lines and also supply current direct to consumers. Private companies can contract with these quasi-public companies for the supply of energy. Since the establishment of the republic, over 500 million crowns have been invested in enlarging and extending power stations, the major part of that sum, having, as indicated above, been applied to the undertakings in which the State and public bodies are participating.

By the time the whole scheme is completed, the State will, it is anticipated, have succeeded in establishing one huge uniform net of transmission lines which will connect up the whole republic, making of it, in respect of electrification, a compact, well-knit unit.

THE INSTITUTION OF ELECTRICAL ENGINEERS' JUBILEE.

FOR the purpose of commemorating the first meeting of the Society of Telegraph Engineers, which was held on February 28th, 1872, the Council of the Institution of Electrical Engineers (originally the Society of Telegraph Engineers) is arranging for the following Institution functions to be held on dates approximately corresponding to that of the original meeting:—

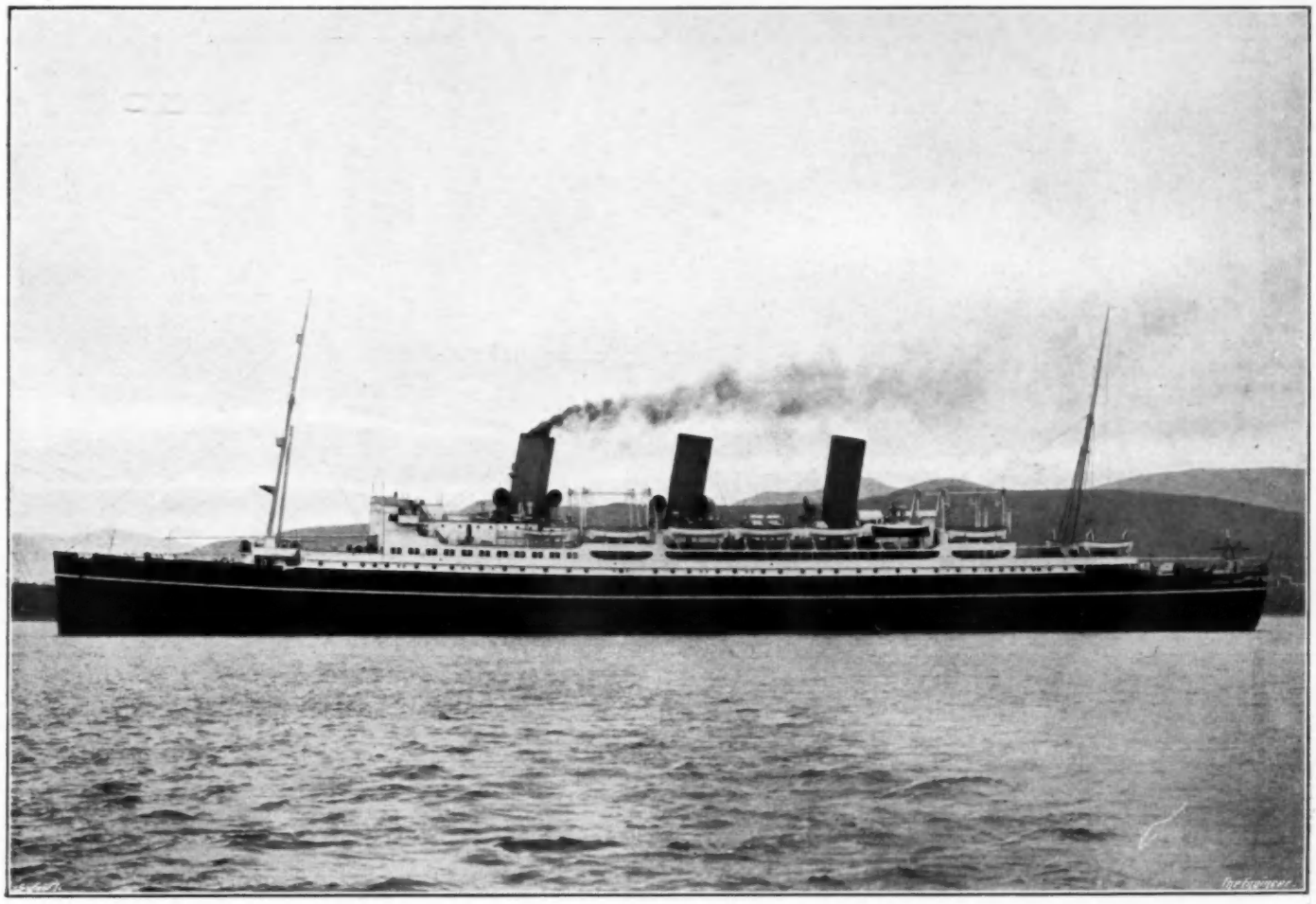
Tuesday, February 21st, at 4 p.m.—Popular lecture (admission by ticket, a limited number of seats being reserved for guests) by Professor J. A. Fleming, F.R.S., on "Michael Faraday and the Foundations of Electrical Engineering"; at 7 p.m. (for 7.30 p.m.), annual dinner at the Hotel Cecil.

Wednesday, February 22nd, at 8.30 p.m.—Professor Fleming will repeat his lecture of the previous day.

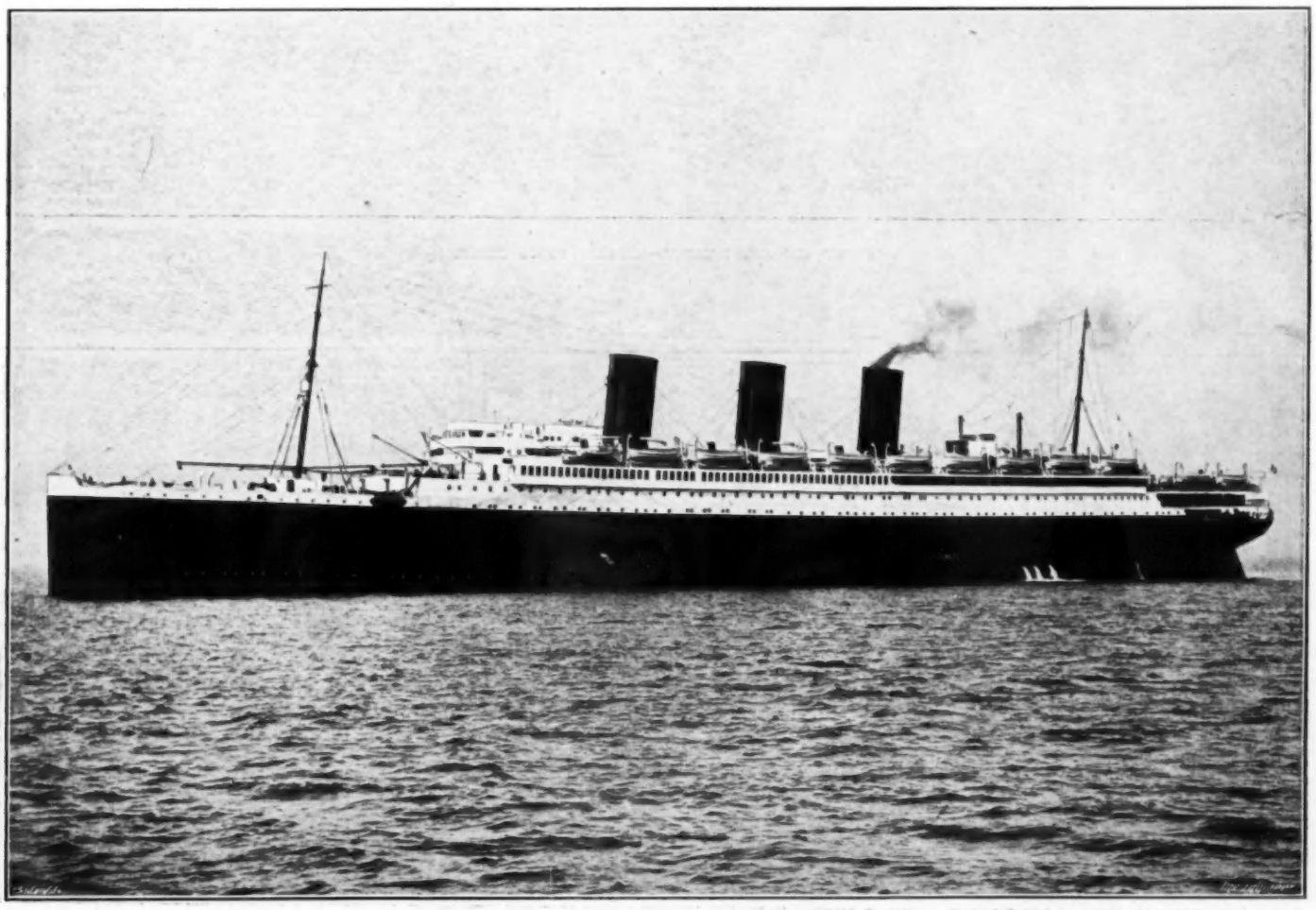
Thursday, February 23rd, from 4 to 6 p.m., and from 8 to 10 p.m.—A number of members of the Institution and others closely connected with the early development of electrical engineering will give short discourses on their reminiscences and experiences during the early history of the electricity supply industry. The speakers will deal both with matters of scientific and technical interest, and also with the effect of legislative action on the progress of the industry. Full particulars of the arrangements will be published later.

THE various proposals for British participation at the Rio Centenary Exhibition—September-November, 1922—have now been resolved into a final and greatly improved form, which seems likely to be successfully carried through. The Department of Overseas Trade estimates that the total cost of a stall 10ft. by 15ft., including sending out a representative, would be about £765.

OCEAN LINERS OF 1921

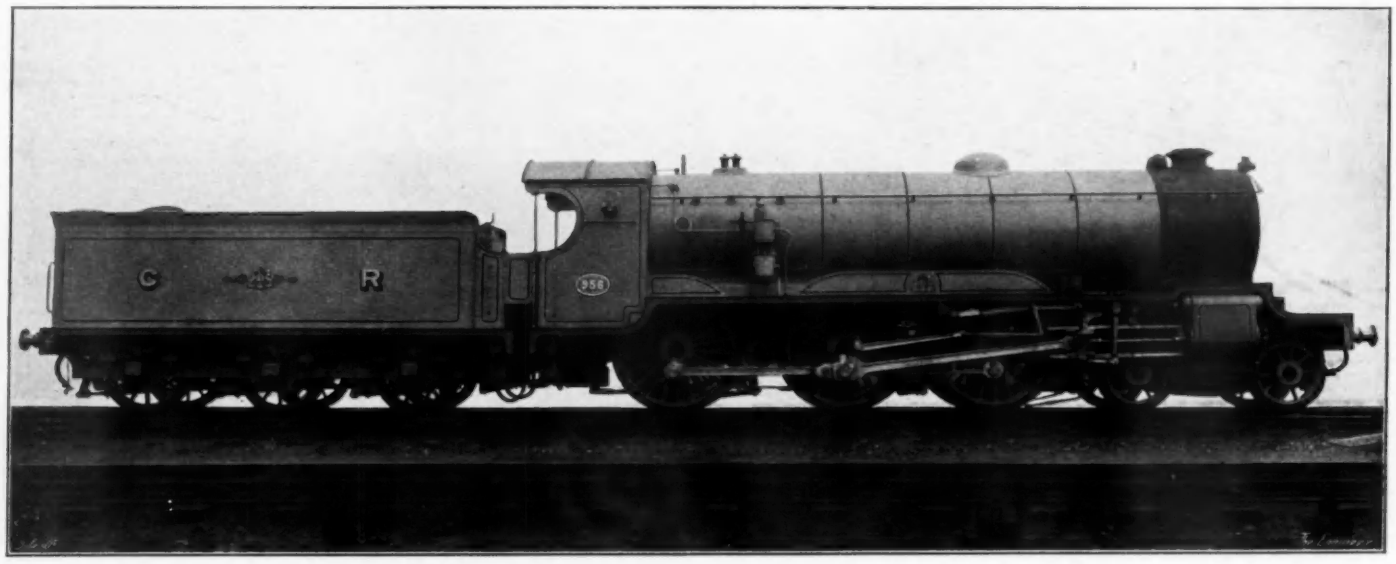


THE EMPRESS OF CANADA—CANADIAN PACIFIC OCEAN SERVICES

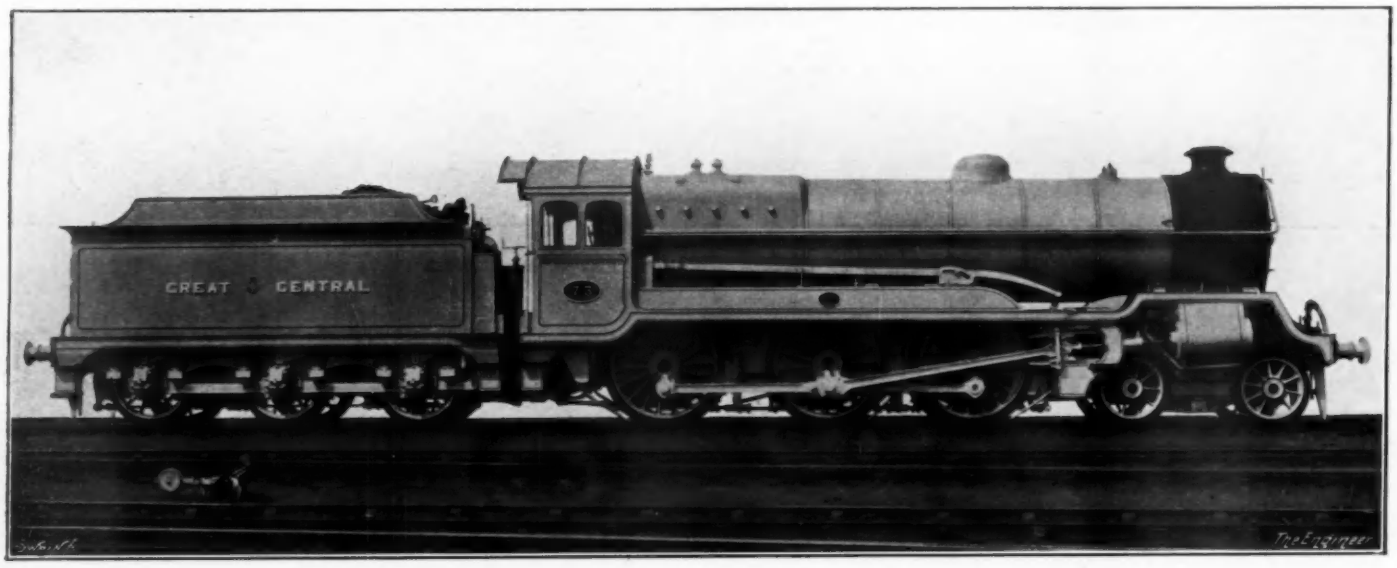


THE PARIS—COMPAGNIE GENERALE TRANSATLANTIQUE

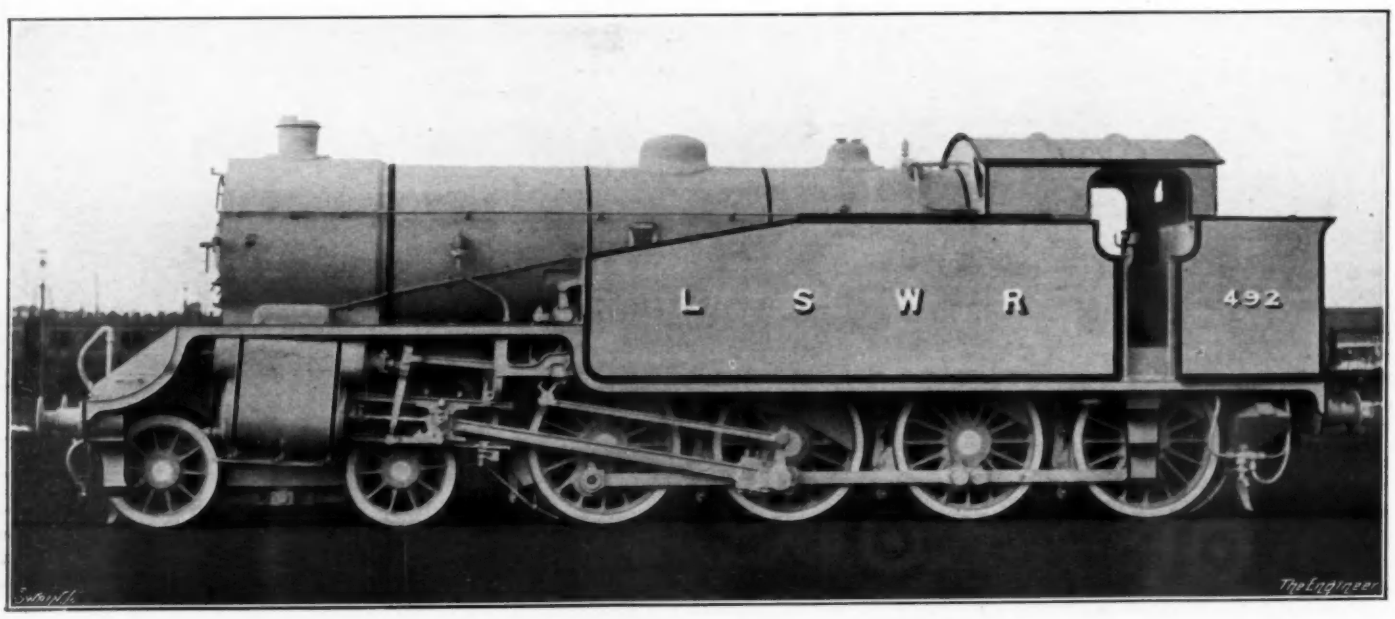
SOME BRITISH LOCOMOTIVES OF 1921



CALEDONIAN RAILWAY—THREE-CYLINDER EXPRESS PASSENGER ENGINE

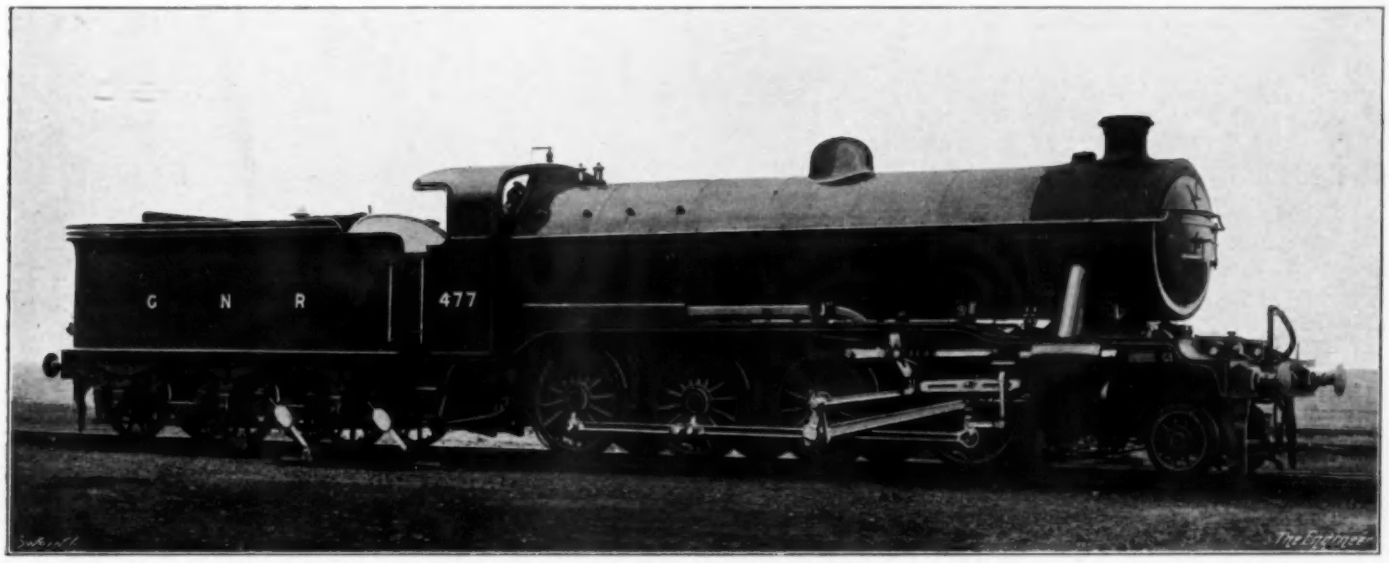


GREAT CENTRAL RAILWAY—EXPRESS GOODS ENGINE



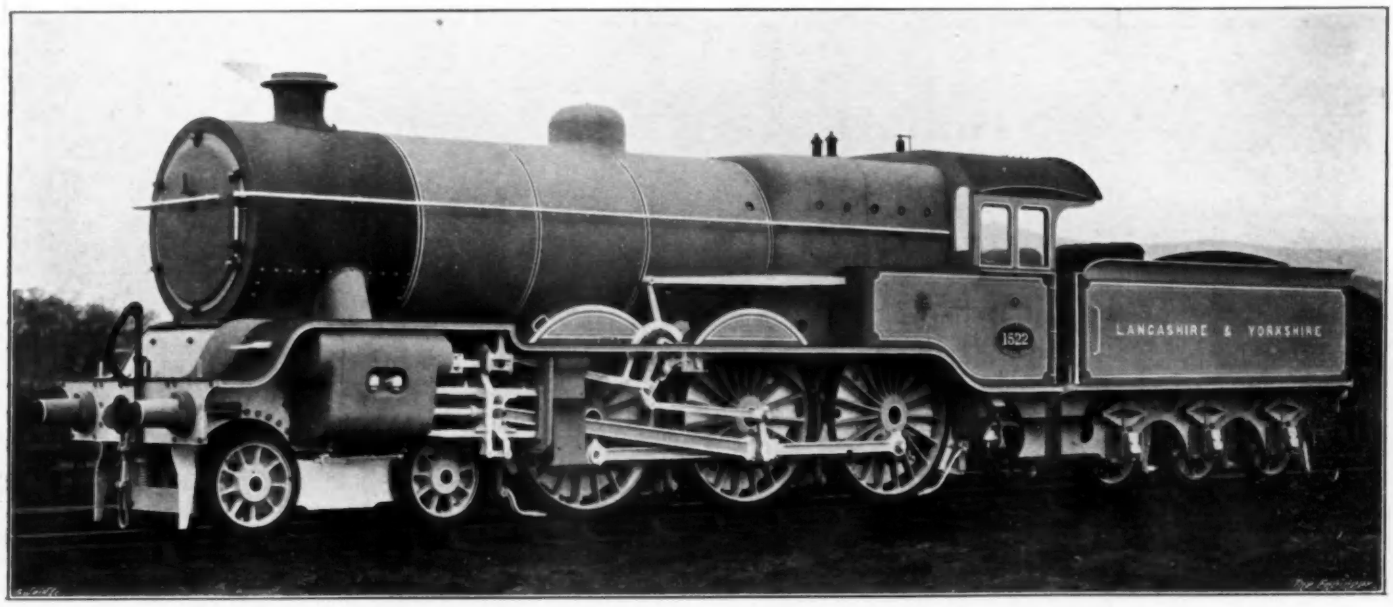
LONDON AND SOUTH-WESTERN RAILWAY—FAST GOODS TANK ENGINE

SOME BRITISH LOCOMOTIVES OF 1921



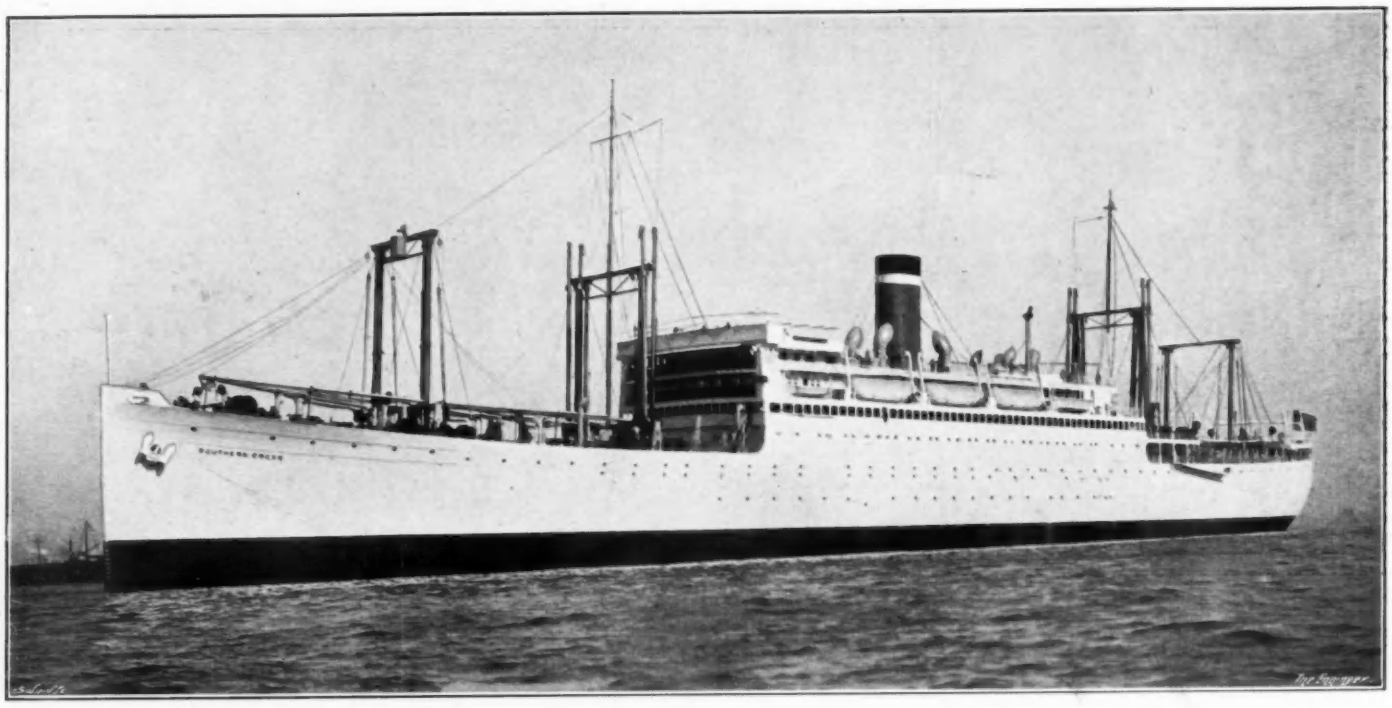
GREAT NORTHERN RAILWAY—THREE-CYLINDER COAL ENGINE

LONDON, BRIGHTON AND SOUTH COAST RAILWAY—BALTIC TYPE TANK ENGINE

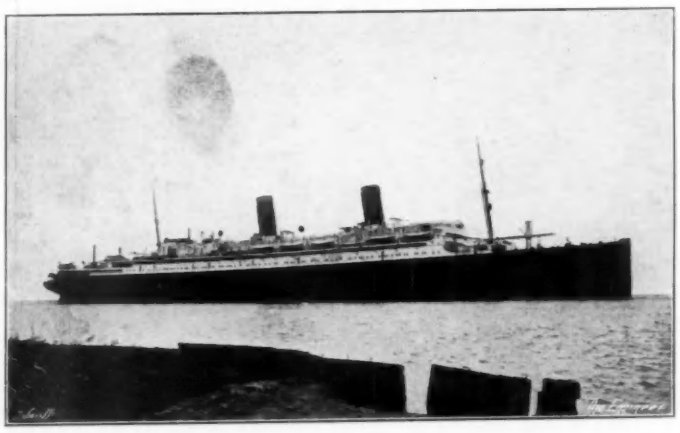


LANCASHIRE AND YORKSHIRE RAILWAY—FOUR-CYLINDER SIX-COUPLED EXPRESS PASSENGER ENGINE

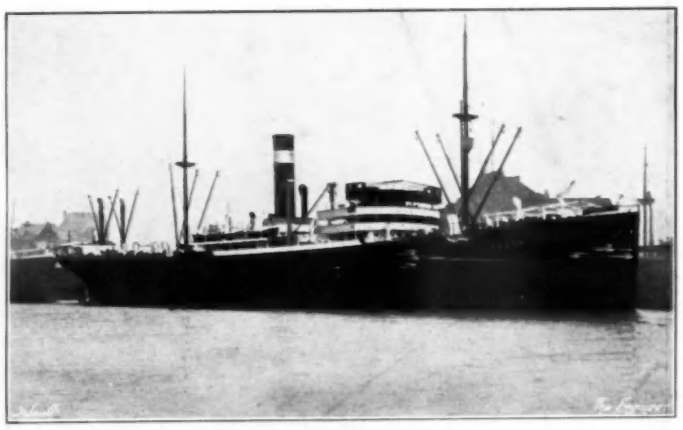
SOME COMMERCIAL SHIPS OF 1921



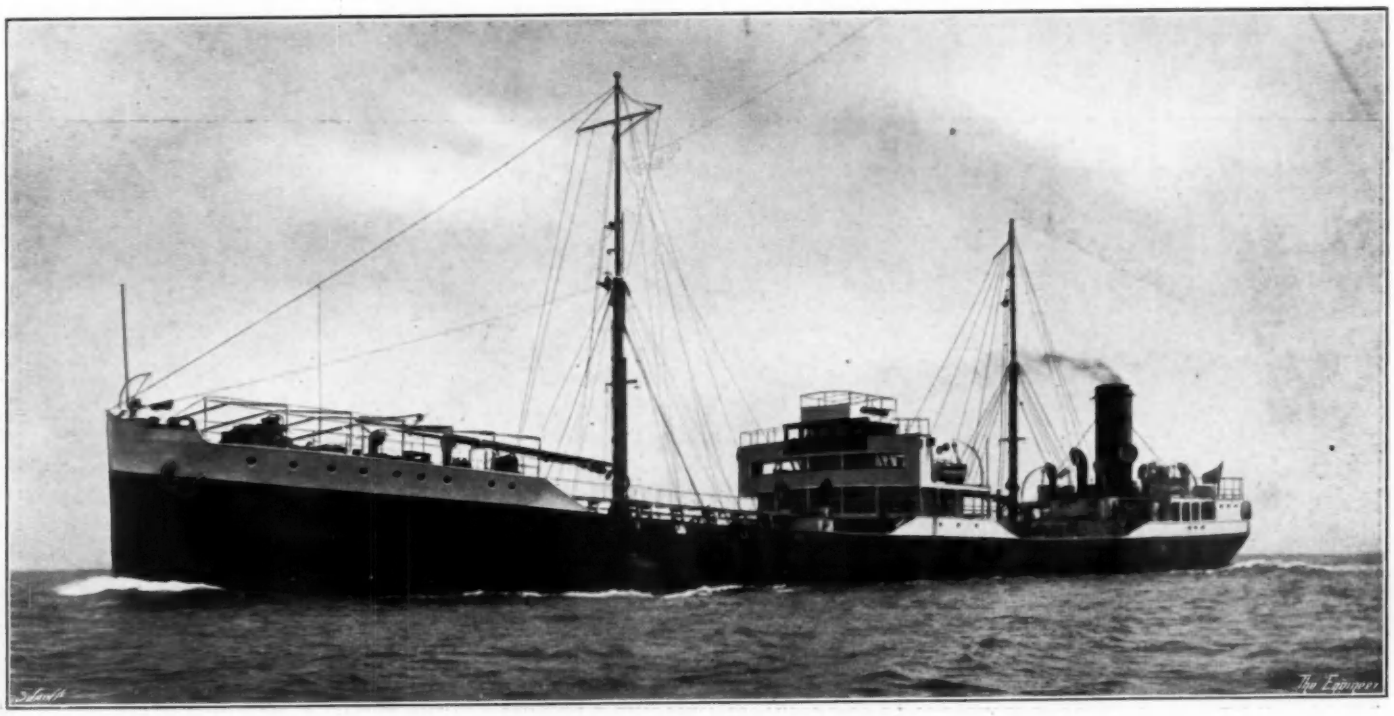
THE AMERICAN-BUILT PASSENGER LINER SOUTHERN CROSS



THE GERMAN-BUILT LINER COLUMBUS, RE-NAMED HOMERIC



THE GERMAN-BUILT TRAMP STEAMER HAGEN



THE AMERICAN-BUILT TANKER ACARDO

Shipbuilding in 1921.

General Survey.

GENERALLY speaking, the outlook of the shipbuilding industry during the past year was gloomy in the extreme, for not only did the industry suffer from all the effects of trade depression which weighed down the other industries of the country, but it was also handicapped by several troubles entirely its own. From time to time work was suspended almost entirely in the shipyards throughout the country, while at other times profitable jobs had to be sent abroad for execution when it was obvious that the British establishments could have coped with them quite satisfactorily had they only been sure of their labour. The first trouble was the strike of the shipyard joiners, which was a legacy of the year 1920, and which lasted well into the period under review. Finally, the men began to give way and to listen to the very fair terms which were offered to them by the employers, but it was not until the greatest distress had been caused in the various building centres, and not before one South Coast yard at least had been able to obtain the services of unemployed artisans at a rate considerably below that being offered to the men by the employers' federation. In the meantime a large number of liners had been sent to the Continent for completion in order to avoid indefinite delay in their commissioning, and although there was a certain amount of sympathetic trouble from the workmen in Germany and Holland—neither very general nor very determined, be it noted—taken all in all, the result was very satisfactory to the shipowner if not to the builder. In France, especially, the work was excellently done, the men putting their backs into it and completing it, as a general rule, in far less than the time agreed upon in the contract, while the reports that were spread to the effect that the work was shoddy and unsatisfactory have proved to be entirely unfounded.

After the joiners' strike, in the spring came the coal trouble, which put the final touches to the depression in the shipping industry and had its inevitable result in the outlook of the builders. Within a very short time practically all the important work in the big centres was suspended and the distress amongst skilled labour was very acute indeed, only relieved to a certain extent by the placing of the Admiralty contracts in the autumn. But no sooner were these contracts well under way than the Washington Conference caused them to be held up and shipbuilders were again faced with a very gloomy prospect until Sir Walter Runciman, at the extreme end of the year, showed his confidence in the recovery of shipping by purchasing a Scandinavian fleet while on the stocks and, through his reputation as a judge of shipping matters, gave a very much more optimistic turn to the minds of shipping and shipbuilding men, although there is nothing concrete yet upon which hopes may be based.

During the early part of the year, until well on into the summer, labour was extremely difficult to deal with, but by the autumn and winter the men had seen for themselves the inevitable unemployment which must follow the conditions then ruling, and they then accepted the reductions in pay rendered necessary by the current prices, and altogether gave promise of thinking sensibly for themselves in financial and other matters instead of being blindly desirous of getting all the money they could regardless of consequences.

The World's Tonnage.

The early part of the year saw the climax of a tendency which had been noticeable ever since the Armistice, that of over-building in the attempt to replace both the losses incurred during the enemy's submarine blockade and the standard ships which were quite useless for practically every high-class specialised trade. Lloyd's Register published figures comparing the world's sea-going tonnage in June, 1914, and June, 1921, which well illustrated this tendency, especially when it is realised that the cargoes now carried are very much heavier and more valuable, and therefore do not employ as much tonnage as they did before the war. The tonnage of the principal maritime nations and that of the whole world is as follows :—

Sea-going.	June, 1914.	June, 1921.
United Kingdom	18,877,000 ..	19,288,000
United States	1,837,000 ..	12,314,000
Germany	5,098,000 ..	654,000
Norway	1,923,000 ..	2,285,000
Japan	1,642,000 ..	3,063,000
Whole world	42,514,000 ..	54,217,000

Prices.

During the year the general slump naturally brought about a very great decrease in prices, and they were still further deflated by the enormous number of German ships which were thrown on the market under the Lord Inchcape sale scheme. At first a certain standard of value was insisted upon, but gradually it disappeared, and finally the ships were sold for what they would fetch to British owners and for very little more to ex-enemies and parties abroad. By the end £5 a ton was considered a very good price for a modern surrendered cargo ship, with the natural result that bitter complaints were made by the owners who had purchased their tonnage dear, and also that many vessels which were considered first-class craft by their German owners found their way to the shipbreakers. Eventually the tangle straightened itself out, and by December practically all the surrendered tonnage was sold.

This very rapid decrease in the value of tonnage, accompanied as it was by no drop in the price of repairs, put the underwriters in a rather awkward position. For an owner was quite justified in insuring the hull of his ship for a reasonable price, but when it came to repairing her after an accident, under the conditions of general average it proved impossible to get the work done at anything like the sum upon which the premiums were based. Hence the underwriters were led to establish what was known as the dual value system, whereby a ship was insured for a reasonably high sum to cover accidents, but if she became a total loss her value was paid on a lower basis and a proportion of the premium returned. Unfortunately, this scheme did not find favour with the shipowner as a general rule, and accordingly hull insurance during the year was in a rather chaotic condition, which had its effect on the shipyards.

The Effects of the Coal Strike.

The national coal strike in the spring had a disastrous effect upon the shipbuilding industry and held up practically all constructional work in progress. Other sections of the yards, however, benefited to a certain extent in that there was an immediate rush to convert all marine boilers to the use of oil fuel. Naturally, it was not by any means every case that was satisfactory in its workings. Oil burned under a boiler has proved exceedingly successful in fast mail packets and the like, but to put it into an ordinary South Wales collier tramp in charge of her usual crew was to ask for the trouble that inevitably ensued. Therefore, the majority of these conversions were made in such a fashion that their owners could return to coal as soon as the situation became more easy, and nearly all of them saw their way to do so. In this connection it is noteworthy that the new turbine-driven liners of the "M" class which have just been added to the British India fleet are designed to burn coal, but have certain of their ballast tanks fitted to take oil and their boilers convertible to liquid fuel at very short notice. Most of the fast mail packets of the cross-Channel services have now turned to oil as being more satisfactory in almost every particular, but the special reason for this adoption of oil firing is the difficulty in re-bunkering with coal in the limited time at disposal between trips.

Liner Construction.

On the face of it the question of liner construction appears to be a little confused, for although the whole tendency of the time is certainly in favour of comfort and simplicity with its attendant cheapness, a number of "liners de luxe" have made their appearance. The reason is that they were all of them begun before the war and had their construction suspended by the struggle, for there is no doubt that the luxurious ocean greyhound of extreme speed is doomed to eclipse for several years to come. Several examples of this type of ship, however, have been slowly completing on the Continent and come into the year's survey alongside their up-to-date sisters with less pretentions, but certainly no less comfort. The three principal ships of this type are the Hamburg-American Bismark, of 56,000 tons, which was purchased by the White Star Line to replace its mined Britannic, and which is to join its mail service in the spring under the name of Majestic; the 35,000-ton North German Lloyd Columbus—see Supplement—which replaced the White Star Homeric of about the same tonnage when it was decided not to recommence her construction after she had been taken off the slips to make way for one of Fisher's "hush-hush" cruisers; and the Compagnie Generale Transatlantique's liner Paris—see Supplement—whose construction was suspended when every available Frenchman was called to the colours, but which has since proved herself a very successful ship.

Most of the really interesting ships of the year are designed for the Australian trade, and the list includes such vessels as the P. and O. Moldavia, of nearly 20,000 tons, which is fitting out at Birkenhead, the 12,500-ton Aberdeen liner Sophocles at Belfast, and the essentially low priced "Bay" liners of the Australian Government and their rivals of the Baradine class which are coming out for the P. and O. Branch Service round the Cape. Most of the difficulties under which the Atlantic Ferry is now suffering do not apply to the Australian trade, and there is great promise for such services as soon as fares can be cut down. The result is that although the vessels being put on the run are comparatively speaking small, yet they are very interesting from the designers' point of view on account of the many economies effected in their construction, and the solid comfort which is being obtained by inexpensive means. On the Western Ocean the Cunard Scythia, after being long delayed in her completion by various strikes, proved herself a great success and her sister Lacoria, kept on the ways by the unfortunate foundering of a French liner directly opposite her building berth, is fitting out to join her. At the beginning of the year the first of the Cunard "A" liners, the Albania, sailed her maiden voyage, and proved herself very successful in securing all the profits that were to be found during the depression. She is a 13,000-ton vessel with a speed of 13 knots, carrying 480 first-class passengers and 11,000 tons of cargo, but her sisters, of which the Ausonia is being completed by Armstrong, Whitworth, the Andania by Hawthorn Leslie, and the Antonia by Vickers, differ from her materially, and carry both first and third-class passengers. On the South African trade the Union Castle Line completed the 19,000-ton Arundel Castle, which was mentioned last year, and will soon be commissioning her sister the Windsor Castle which was launched by the Prince of Wales at Clydebank. The South American trade has one of the most important ships of the year in the 22,000-ton Giulio Cesare which Swan, Hunter built for the Nav. Generale Italiana and which will run alongside her sister the Duilio, completing at Ansaldo's yard at Genoa. The competition between the British and Italian-built ships is expected to be keen, but if the Tyneside vessel fulfils the promise of her trials she will want a lot of beating. Lamport and Holt launched a 13,000-ton ship, the Vandyck, whose design is a development and improvement on their well-known pre-war "V" packets. The list of the more important new liners is completed by the Trans-Pacific Empress of Canada—see the view given in the Supplement—for the Canadian Pacific Line, which has not yet gone out to her station, the Pittsburgh and Doric, vessels of about 16,000 tons which are being built for limbs of the International Mercantile Marine, and two more Atlantic "M" liners for the Canadian Pacific.

During the year opportunity was taken of the necessity for reconditioning, after war service, to introduce a large number of improvements and modernisations into some of the well-known liners, many of which have been given a new lease of life by this means. After a disastrous fire in the summer, the Mauretania was sent to the Tyne to be converted to liquid fuel, and the Berengaria (ex Imperator) followed her a few weeks later. The new season will thus see all the crack ships on the Atlantic Ferry burning oil.

Fast Mail Packets.

The London and North Western Railway completed their two new classes of 25-knot cross-Channel packets which have proved entirely successful, while the French-built Versailles has joined the Dieppe route and maintained her 24 knots. The Japanese, learning by the failure of their own steamers a few years back, are having two moderate-sized express packets for the Shanghai Mail Service built in this country. The French also have had a noteworthy packet built by Cammell, Laird, but in her case the speed aimed at is more moderate.

Motor Ships.

The progress of motor ship construction during the year was noteworthy, for not only did a number of first-class cargo vessels make their successful appearance, but a start was made with the propulsion of passenger liners by internal combustion engines. The first ship to be specially so designed is the British India Domala, which starts her maiden voyage in the New Year, and will be given a very exhaustive series of trials in competition with the steam-driven vessels of the new "M" class, her sisters in every particular except machinery. But while she was completing, the Elder Dempster Company, which had purchased the cargo vessel Glenapp, launched in 1918, converted her into a mail packet for their West Coast trade with very extensive and elaborate passenger accommodation. Harland and Wolff have practically standardised their 6500-ton motor ships and have turned out three for the Pacific Steam Navigation Company—Lobos, La Paz, and Losada—which are running quite satisfactorily. Meanwhile the unlimited promise of the motor ship is shown by the fact that as soon as the Bibby liner Somersetshire was completed she was chartered by the Royal Mail Steam Packet Company for its British Columbian service, although it already had a number of suitable steamers laid up. Motor tankers have also shown their value very conspicuously during the year, and were it not for the fact that the world already possesses plenty of this type of tonnage there would no doubt be quite a number of them on the stocks. But one of the most interesting motor ships of the year, whose performances are being watched with the greatest interest by marine engineers, is the Swedish Yngaren, of 5224 tons, which is the first vessel to be fitted with the much-discussed Doxford opposed-piston motors. Motor ship construction in 1921 is dealt with at greater length in another page.

Electric Propulsion.

We have heard a lot about electric propulsion in merchant ships on the other side of the Atlantic, but the news has been so befogged by ignorance on the part of the writers, and political bias on the part of the people who should be in a position to know, that it is very difficult to discover just how the land lies. The big freighter Eclipse has completed several voyages since her geared turbines were replaced by turbo-electric machinery, and the Shipping Board

officials have expressed themselves as being delighted with her performance. At the same time they leave one in a certain amount of doubt as to the reason of their happiness, and whether it only exists when the new installation is compared with the old geared turbines. However, they have proceeded with the conversion of a large number of other steamers, but in every case they are minimising the expense, and therefore putting the motor where the gearing used to be. Swedes, British and Japanese are all experimenting with electric ships designed as such.

Welded Construction.

No progress was made with welded ship construction during the year. The little coaster Fullagar was tolerably successful, but was grossly over-engined, and when she had been given a new motor of about half the original power her owners did not care to worry any more about her, and she was sold. At the same time welding and cutting has been taking an ever-increasing part in repair work despite the troubles with labour.

Fittings.

Very few fittings of any very great distinction were brought forward during the year, but considerable interest attaches to the American experiments on a large scale with the fitting of the gyroscopic stabiliser instead of the older-fashioned anti-rolling tanks. The American navy is taking a hand in these experiments, but the gear is also being fitted in a number of new passenger vessels sailing under the Stars and Stripes. The Union Castle liner Arundel Castle aroused particular attention by her Topliss boat-lowering gear, which is a great improvement on that fitted to the ill-fated White Star Britannic, and which will probably be seen in quite a large number of the big ships turned out by Harland and Wolff in the near future. Tried under sea conditions it got a dozen boats over one side in 19 min. without the least difficulty, and has been pronounced by the men who manage it as practically fool-proof and satisfactory in every particular except for the inevitable disadvantage that in spite of many ingenuities it adds a lot of top weight. Another feature of the year is the marked increase in the favour with which electric winches are being regarded on shipboard, their greatly improved reliability doing away with practically the last disadvantage that could be alleged against them.

Concrete Shipbuilding.

Despite the efforts of certain German and Scandinavian parties to prolong the life of the craze for concrete shipbuilding, it may be described as practically dead except under very exceptional circumstances, the final blow to its prestige being given when the much-vaunted concrete steamer Faith, of 3000 odd tons was sold to the scrappers at a price which did not nearly cover the claim brought forward by her crew for wages owing.

Ship Repairing.

The cost of ship repairing was maintained throughout the year at a very high level, principally on account of labour which, especially in the earlier months, resulted in a number of valuable British contracts going across to the Continent. Bad blood naturally resulted, and the proposal of certain shipbuilders to clear the matter up by a joint inquiry into the whole causes came to nothing owing to the Boilermakers' Society insisting on widening its field until it would not only have become impracticable from the first, but would not have achieved the objects which were in view.

In the autumn there was a particularly unhappy example of labour bigotry when the ship repairers on the Mersey refused to use the two-men burners unless no less than twenty-three others were kept standing by on pay with their hands in their pockets. This attitude led to a dispute which crippled the industry on the river, and caused great distress until the men finally gave way.

Altogether the year 1921 was a very depressing one from the shipbuilders' point of view, but it ended with promise of very much better times ahead.

THE NEW YEAR HONOURS.

AMONG the names included in the New Year list of honours are several of gentlemen who are engineers or who are closely connected with the profession. A peerage has been conferred upon Mr. Joseph Watson, chairman of Joseph Watson and Sons, Limited, and a director of the Lancashire and Yorkshire Railway. During the war he rendered signal service in organising shell-filling factories. Among those created baronets are Sir Henry M. Grayson, Director of Ship Repairs at the Admiralty during the war; Mr. D. R. Llewellyn, the well-known Welsh colliery and shipowner; Mr. James Readhead, chairman of John Readhead and Sons, Limited, shipbuilders, and a member of the London Committee of Lloyd's Register of Shipping; and Mr. Hugh Reid, chief managing director of the North British Locomotive Company, Limited. The honour of knighthood has been conferred upon Mr. William Graham, managing director of the Cardiff Dry Dock and Engineering Company; Professor W. A. Herdman, president of the British Association; Mr. A. J. Hobson, vice-chairman of High Speed Steel Alloys, Ltd.; Mr. C. R. S. Kirkpatrick, chief engineer to the Port of London Authority; Mr. A. S. Mays-Smith, president of the Society of Motor Manufacturers and Traders; and Mr. Alexander Richardson, joint editor of *Engineering*. Professor C. S. Sherrington, president of the Royal Society, has been created a Knight Grand Cross of the Order of the British Empire.

Foreign Patents.

INVENTORS will be well advised to follow closely the rapidly changing laws of foreign countries, both as to their provisions and the scope of the territory covered, particularly as in some cases some fields are now protected by letters patent for inventions in which no such monopoly heretofore existed.

Among some of the later alterations to patent laws there may be noted new acts covering the country of Bulgaria and the Free City of Danzig.

FREE CITY OF DANZIG.

The statute in respect of this city falls somewhat on the lines of the old German law, but presumably no search is to be made by the examiners to determine the novelty of an application. It has already come into force. New inventions which are capable of industrial application are protected by their record in the patent register according to the provisions of this new law, but there are excepted inventions relating to articles of food and substances prepared by chemical processes in so far as these latter do not relate to a definite process for the preparation of the products.

Somewhat against the German Petty Patent Law, it is provided that models of working arrangements or useful objects or parts thereof are regarded as inventions in so far as they are intended to serve for the purpose of operation or of use by reason of novelty of form or the like. Publication which defeats novelty is publication only within the territory of the Free State and not elsewhere. This follows the British practice, as does also the statement that the patent covers the industrial exercising, vending or user of the invention. A specific indication is to be found in the law not found in that of this country that the patent covers in respect of a process patent the products directly manufactured by the process, so there is no need to insert a claim for them. As with some other countries it is definitely provided that the patent is not valid against anyone who at the time of the application had used or made the necessary arrangements for using the invention in the Free City. As this City of Danzig has now become a party to the International Convention, and inventors are therefore liable to rely on their British date for obtaining protection in that city, they must recollect that under this provision of the law anyone else who prepares to manufacture in Danzig before the actual application is filed in Danzig, notwithstanding the benefits conferred by the International Convention, is free to continue such manufacture, and this right can be disposed of in the nature of goodwill with the business.

The patent term is seventeen years. Compulsory licences are provided for. German rights based on an application in Germany before the present law are recognised as being effective. The County Court in the Free City of Danzig is the Court for all complaints under the Statute, no matter the value of the material in dispute.

BULGARIA.

The law in Bulgaria provides for both main and subsidiary patents for all inventions capable of industrial application with the exception of those relating to food and the like. Here, again, the publication which negatives novelty is publication in Bulgaria and not elsewhere. A process patent includes the direct products of the process and, as in the above Free City of Danzig, a patent is not effective against those who were working or were prepared to work the invention prior to application date in Bulgaria. Patents of addition may be converted into principal patents, in which case the period of protection runs from the time when they were lodged as additional patents. Otherwise the patent expires, as is usual with the main patent.

The term of a principal patent is fifteen years. Twelve months' priority are granted for filing in Bulgaria after an application has been filed in a country foreign thereto. No search is made before Bulgarian patents are granted. Criminal proceedings may be instituted against infringement, and in case of new products any product of the same nature is to be deemed, until proved to the contrary, to have been made according to the patented processes.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

DEAN, SMITH AND GRACE (1908), Limited, have severed their connection with the Associated British Machine Tool Makers, Limited, of 17, Grosvenor-gardens, London. All business is now being dealt with direct by the firm from Keighley.

WE are informed that the manufacture of the Kestner boiler in this country has been taken over by Ransomes, Sims and Jefferies, Limited, of the Orwell Works, Ipswich, who hold the sole licence and selling rights for the United Kingdom, the Colonies, and Dependencies, South America, the Dutch Indies and China.

WE are asked to state that the interests of the Wege Motor, Limited, makers of the Wege valveless, gearless engine, of Adelaide, South Australia, are represented in this country by Mr. Chas. C. Deland, director, at 64, Torrington-square, Bloomsbury, London, W.C.

LAUNCHES AND TRIAL TRIPS.

MAID OF HYDRA; built by J. I. Thornycroft and Co., Limited, to the order of Mr. Michael Kinbiricos; dimensions, 240ft. by 36ft. by 18ft. 6in. Engines, triple-expansion, 18in., 30in., and 50in. by 33in. stroke, pressure 180 lb.; launch, November 16th.

SONGA; built by Sir W. G. Armstrong, Whitworth and Co., Limited, to the order of Lorentz W. Hansens Rederi, Norway; to carry 5000 tons deadweight. Engines, triple-expansion, pressure 180 lb.; Howden's forced draught fitted; constructed by the builders; trial trip, November 22nd.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Welcome 1922.

BIRMINGHAM and the Midland district generally have during the past year had to endure the worst brunt of the iron and steel and engineering trade depression which has swept the country. Though the prospects for the year 1922 are none too bright, it is realised that it can hardly be a leaner year than the one just passed. There is just the possibility with iron and steel prices alike raw and finished and "semis," coming down to a reasonable level and production and labour costs approximating more to the value of the product, that the new year now entered upon may develop into a satisfactory one. The Midland industrial district has suffered perhaps even more severely than any other area in the kingdom. Not one of its staple industries but has a bad tale to tell. Half production, reluctant markets at home and abroad, reduced profits and reduced wages—and still depression and unemployment. Yet without doubt the predominant sentiment in every mind to-day is a hope that 1922 will prove a better year than that which has just passed. Speaking on Monday to the Council of the Birmingham Chamber of Commerce, Mr. H. G. Field said that, while they could not necessarily look for a great access of prosperity or possibly an increase of trade in the New Year, they could congratulate themselves that the general outlook all the world over was towards a readjustment and reorganisation of the industry of the world at large to meet the new conditions. That reorganisation was absolutely necessary before any great improvement in trade could be looked for. They had stepped up on to a platform of high prices, good trade, and high living expenses. Now they had to step down. Though there were many difficulties in front of them, the peoples of the world as a whole had determined on peace and readjustment, and when that was the case the will of the peoples of the world was bound to have its way. There is a considered opinion in engineering circles here now that foreign competition has become less severe, especially in the iron and steel trades, that there will be more work about in the near future. Brisker conditions in the home market are expected, as consumers have been restricting their purchases of material below reasonable requirements. There is, indeed, a long pent-up demand for iron and steel products waiting to be satisfied, and there are inquiries about which give the impression that trade is at least convalescent. There is no likelihood of productive capacity being overstrained by the process of replenishing nor of the downward trend of prices being more than temporarily arrested. Ironmasters and coalowners in this district are more dissatisfied each week with the recent revised railway tariffs, which promise, they say, no real tangible relief to transport facilities in the Black Country. Efforts will be made in the year now commenced to induce the railway companies to be more generous and to fix rates which show they are willing, as manufacturers are, to make substantial sacrifices in an endeavour to resuscitate trade. Lower prices in the iron trade cannot, it is said, be accepted unless carriage costs decrease, while Midland smelters contend that there is no prospect of their relighting their furnaces until carriage and production costs are such as will enable them to produce at a profit. Much is, however, hoped for and every effort will be made to put the industries of Birmingham and the Midlands in a sound position once again.

Engineering Prospects for the New Year.

There are many indications of the growing confidence that the New Year will see a diminution of depression in the engineering trades of the Midlands. Manufacturers base this belief to some extent on the now almost complete liquidation of surplus war stores, the disposal of which has severely affected a large number of the miscellaneous industries carried on in the Black Country. Last year was one of the most trying that the various branches of engineering have ever passed through. There were large accumulations of manufactured goods of various descriptions which the markets for which they were destined were unable to assimilate. These had to be liquidated before production could go forward. These accumulations are gradually getting less, and on their exit a more hopeful tone enters. The slackness in the motor car trade has been responsible for a large number of unemployed engineers. Work will this year be concentrated on the new models, and it is expected the gradual improvement noticeable during the past few weeks will be maintained and slowly become stronger. A more optimistic tone concerning the outlook for the spring is gaining ground, especially in the Coventry area. Much depends, however, on the restoration of the overseas trade. With regard to the heavier branches of engineering, the outlook here again is brighter, and orders which have been held up are now expected to be given out and many plans prepared months ago are expected to be proceeded with. A certain amount of structural work has already developed. Structural engineers have recently received invitations to tender for various steel structures, such as bridges and other constructive steel work, involving in the aggregate some hundreds of tons of steel. Some slight improvement is also noticeable in the rolling stock department, orders for a few hundred wagons having been placed, with considerable activity in the way of repairs. It is generally expected that many of the colliery companies will this year proceed with necessary development and improvement work which was held up on account of the enormous losses of many of the companies over the three months' coal strike. The railway companies also have much work which should be put in hand without further delay, and with prices of material down to a more reasonable level there is little doubt but that much of the work which has been held up will now be released. The branch of engineering which has suffered least is that which has to do with electrical undertakings. It has owed some part of its comparative activity to the development in the direction of hydro-electric power. Considerable contracts are being

carried through for compressor work in connection with refrigerator plants and other enterprises. Numerous projects for electrical coal mining or for the installation of electricity for haulage and other purposes in collieries have been under consideration, and in some cases plans have been prepared. Constructional engineers are now busy in getting out drawings and estimates for contracts which the cuts in steel prices are bringing within sight. With values still falling contracts are still being held back, but they will come along in good time.

Pig Iron Trade Future.

The future of the Staffordshire pig iron trade is far from clear and the depression has told severely on this district. A large proportion of its raw material is brought from a distance, so that it is peculiarly susceptible to any increase in transport charges. The doubling of the railway rates has been too heavy a handicap for local industry to bear. The position has not been much mended by the small concessions of the railway companies of November and December. Only four furnaces out of twenty-nine are in operation and the largest firms are passing through very trying periods, with poor production and enormous overhead expenses. The amount of demand which develops during the first fortnight of this year will determine whether a number of furnaces will continue operating or be shut down. During the year the pig iron industry has had to contend with very severe competition from the Continent, but smelters start the year minus this very serious problem. Prices have been cut to such an extent of recent months that it is now practically impossible for the continental makers to compete, and at the moment the dumping of foreign iron here is comparatively small, and even this is restricted to consumers near the port of arrival. The signs are that this foreign competition will be a less important matter to smelters in 1922 than it was in the year just passed, and it is something to have wrested from the foreigner the hold he had got, even if it meant for a time the sacrifice of profits. This is about the only bright spot in the pig iron firmament, for coke remains far too dear at 22s. 6d. per ton. With excessive railway rates added to the burden of dear fuel, smelters in this district cannot manufacture iron except at a considerable loss. There is little demand at present for either forge or foundry sorts, and those furnaces which are blowing are putting into stock. For some time now there has been no Staffordshire pig iron on the market, and with the exception of a little all-mine cold-blast iron the year opens with no Staffordshire iron obtainable. The Staffordshire furnaces that are in operation are consuming their total production in their own works.

Manufactured Iron Outlook for 1922.

The predominating feature of the finished iron trade during the past twelve months has been the slump in prices, and ironmasters are to-day paying dearly for the inflation of prices following de-control. When the year opened a struggle between consumers and producers commenced, and the determination of the former to break prices eventually met with success. Marked bars, which stood at the record figure of £33 10s. in January, finished up the year at £16 and unmarked or Crown bars, which started the year at £28 10s., can now be bought at £13 from members of the Bar Makers' Association, and at almost £1 less from unassociated houses. The prospects of the bar iron trade are not exhilarating. The greater the depression the more protracted must be the period of recovery. With prices down to a level which has arrested foreign competition there is a hope of better things. The common bar branch is now the only one in which the foreigner is able to undersell us. The stagnation in the nut and bolt trade and also in the chain and anchor trade is having a depressing effect on the local iron trade, and the nut and bolt trade, which ordinarily takes large tonnages of common bars, shows no signs of improvement. The slump in shipbuilding is affecting the best bar houses, though they are not so badly hit as their kinsmen in the Crown bar department. None of the ironworks is making full time; indeed, it is only with difficulty that they are keeping the mills going from day to day. There is a flicker here and there and manufacturers are keenly watching for trade openings. They are ready to meet the demand when it arrives, which they hope will be at no far distant date. In the meantime hopes are centred on the Birmingham quarterly meeting, which takes place on January 12th. It depends to a large extent how demand develops at that meeting as to what many ironmasters will decide to do in the near future.

Cannock Chase Coalfield.

Burdened with high railway rates and hampered by poor water transport facilities, the coalowners of Cannock Chase look into the coming months with considerable apprehension, but they are hopeful of winning such further concessions as will enable them to compete successfully in the markets and so restore Cannock Chase coal to its old-time sound position. The past year has been one of the most extraordinary periods ever experienced, and neither colliery proprietors nor miners are desirous of again going through such trying ordeals. The disastrous effects of the three months' strike are still being felt both by the employers and the men. Handicapped as they have been by the strike and its after effects, the local coalowners have not been able to launch out on many new developments during the year. Certain important work in many of the collieries has, however, proceeded, and in one the closure of some of the seams has been counterbalanced by extending operations in new sinkings. The sinking of shafts at the side of the main road from Wolverhampton to Cannock by the Holly Bank Colliery Company, Limited, which is still proceeding, is the most notable local mining development in the past quarter of a century, for experts declare that the output of the pit will be at least a thousand tons a day for a hundred years. Closely related to the demand for an increased output of coal is the increasing use of electricity for coal-getting purposes—a policy which has been more widely carried out in recent months. The delivery into the district by the Wolverhampton Corporation of a big supply of electricity has added significance in view of the growing utilisation of coal-cutting machines in the local mines.

Cannock Chase Miners' Wages.

The ascertainment of miners' wages in the Cannock Chase area for the month of January give the men an increase of 109.86 over the 1911 basis, as compared with 109.54 for the month of December. This increase amounts to 1.32 part of a penny per day, with the exception of two or three grades, where the increase will be a penny per day.

LANCASHIRE.

(From our own Correspondent.)

MANCHESTER, Thursday.

Iron, Steel, and Metals.

NATURALLY one did not expect to find much change in the iron and metal markets here on the first market day of the year. Members of the trade have moved to the other side of the Manchester Exchange, and buyers are now accustoming themselves to the new position. Very little business was concluded this week, but there is a rather more hopeful feeling generally, although one cannot find any very definite ground for it. It is quite clear that further readjustment of prices in the iron and steel trade have yet to take place and that they will still be in a downward direction. While this process is going on it is out of the question to suppose that a revival in trade can take place. How long a time will be occupied in getting the price down to the bottom one cannot say. The process would be quick enough if there were unlimited and free competition and no combinations and associations to hinder the fall. The hampering effect of these organisations has been felt all through the last year, and has delayed the return to sound conditions whence a steady revival of trade might spring.

Metals.

The market for copper remains quiet, and there is no sign yet of any inclination to buy on the part of consumers. The price of best select copper remains comparatively low, although there is still a widening tendency between it and standard prices. The American position seems to be unchanged, and one hears nothing more yet about the probability of resumption of work at the idle establishments. Nevertheless, this cannot be delayed very much longer, although it is possible that when more producers begin operations the consumptive markets will be better. In any case, the prices cannot very well be depressed much farther, whatever may happen. There are one or two signs that we are slowly working towards better trade conditions, but the optimism of some of our leading business men seems out of place. The recovery must be slow, and probably must meet with many delays and interruptions; but if it moves steadily on throughout the early months of the year it is not impossible that the second half of the year may be satisfactory. The prices of manufactured copper and brass have not been altered yet, but it is probable that some of the more extravagant of these prices will soon be reduced. The market for tin has been rather less active of late, and the prices are back a little; but the general feeling is fairly steady, and the set-back is believed to be temporary. The buying from America tailed off, and their support was therefore lost for a time; but the possibility of an American import duty on tin is still in existence, and may lead to more anticipatory buying for American account. The market for lead has been rather easier, and there was a reduction of £1 per ton on sheets and pipes; but these prices are, like the manufactured copper prices, far too high, as is shown by the fact that export orders are taken at £3 per ton less than the prices charged to the home consumer. The ease in the market seems to be connected with the Franco-Spanish Customs dispute. In spelter there is, up to the time of writing very little movement, but opinion in the market is favourable to a rise.

Pig Iron.

The demand in Manchester for foundry pig iron seems now to have fallen to its lowest limit. One reason for this is, of course, that many of the local foundries are short of work; but another important reason is that consumers have as yet no confidence in the market. Six months ago £5 per ton would have been thought an impossibly low price for No. 3 pig iron, but that point of view has changed, and now it is considered too high a price to be safe. The refusal of the railway companies to make any further concession in the rates for pig iron and low-priced iron goods, such as castings, is a disappointment, but one cannot be surprised. The railways have difficulties in getting their expenses down just as the iron and steel trade has difficulties, and reduction of railway charges cannot move very fast. There is some uncertainty here about the prices of foundry iron, but nothing has been heard of under £5 per ton, except a few lots of local iron from the Partington works.

Finished Material.

Further reductions in finished iron and steel are expected, although it is generally admitted that the present prices do not pay. One hears of very low prices accepted for foreign orders down to £8 5s. per ton for joists, and this suggests that much lower figures might be quoted for the home trade. Almost all the steel works are closed at present, and in some cases the re-opening will be delayed; but when they are all working again there must be keen competition for the few orders available.

Scrap.

The market for scrap is quiet and dull, and business in it has scarcely begun yet. It is, however, expected that the prices for foundry scrap will be considerably lower.

The Engineering Trades.

Most of the engineering firms of this district ceased work entirely for the last week in the old year to reopen on Tuesday last, and they probably never had a better excuse for making an extended holiday. The past year has been, for all but a few branches of the engineering industry, the most disappointing on record, but rightly or wrongly, there is a feeling prevalent that the dawn of better times is faintly visible. On all hands I hear that inquiries have become more frequent, and in several cases orders have recently been booked. The cheapening of coal for industrial purposes and the lowering of railway rates are factors which will have a good influence on trade generally, by reducing the cost of production and thus enabling the British manufacturer to compete on slightly better terms with the foreigner. But there is a strong feeling in Manchester that our Consular service is far from being efficient. Speaking a few days ago on this subject, Sir Edwin Stockton, the energetic chairman of the Manchester Chamber of Commerce, complained that the full strength of our trade commissioners was nominally about twelve, and that three of the posts are being left vacant for reasons of economy. He asked how it was possible that a country the size of India, for instance, could be served by one commissioner. The remaining eight commissioners were, he said, distributed over Canada, Australia, New Zealand and Africa. The importance of trade commissioners to our foreign trade is one which cannot be too forcibly impressed upon the Government at the present time. I was talking only a few days ago with an engineer who has recently been travelling on the Continent, and he mentioned to me a case to illustrate how the Germans, with their methods of "peaceful penetration," are establishing themselves again even in countries which were so recently their enemies. They seem to have plenty of money too, which they are wisely investing out of their own country. The particular case to which my friend alluded was a certain kind of factory in Italy, which is being equipped with German machinery, but no money is passing from the purchaser to vendor, the latter being satisfied to take payment in shares in the undertaking, just as was frequently the case in connection with mill shares in Lancashire some years ago. In addition to acquiring in this way a financial interest in the undertaking, my friend found that Germans were being engaged in important posts in the factory. What is happening in Italy is, no doubt, going on elsewhere. Much curiosity is evinced by engineers in the conference for establishing the trade of Europe. If the outcome of this is the restoration to some extent of the normal facilities for international trade and a guarantee of the stability of the currency, much will be accomplished. Russia alone is capable of finding employment for a very large section of the engineering industry. Great developments are possible in China, and German engineers are keeping a close eye on both these countries.

BARROW-IN-FURNESS, Thursday.

Hematites.

The New Year opens with the hematite pig iron trade of this district in a depressed condition. As regards production, that is in a very low state, for in the whole of North Lancashire and South Cumberland there is only one furnace in operation, and that is at Ulverston. It is quite likely, however, that next week will see a renewal of activity at the Barrow Ironworks, and possibly at Millom. The output at Barrow is usually largely used up in the firm's own steel works. The demand for pig iron remains very quiet, but may look up after a while when conditions are more settled and buyers can do business at what they consider is a right price. The reduced railway rates will ease down prices to a small extent.

Iron Ore.

With the number of furnaces working so few, the current demand for iron ore is of necessity limited, and at the mines at present there is almost a complete lack of activity. The arrivals of Spanish ore continue at the rate of about one cargo a week into Barrow.

Steel.

Nothing is being done industrially in the steel trade with the whole of the plant and mills standing idle. Work will probably be resumed at Barrow next week. The demand all round for steel of all descriptions is very quiet. At present delivery is being made from Barrow of a rail order on Indian account.

Shipbuilding and Engineering.

These trades are still on holiday. They re-start on Monday next, but still on short time.

SHEFFIELD.

(From our own Correspondent.)

Ready for the Restart.

ALTHOUGH during the past week local trade conditions have not materially changed, the holiday has, in spite of the prolonged depression and unpromising outlook, been no longer than is customary, even at normal times, and generally speaking, the big steel and engineering works have during the present week re-started operations on the restricted scale now common to most of them. One explanation of this comparatively early re-start is in itself a symptom of the slackness rather than indicative of improvement. In normal times, the Christmas holiday has frequently been taken advantage of for the much-needed overhauling and repair of plant, with the result that some works have been closed for a week or ten days or even a fortnight. Now, however, there has been sadly too much opportunity for the little repair work that has been necessary, and with their attenuated holiday resources so quickly exhausted, workers have been only too eager to get back to the part-time employment that awaits them—and feel themselves lucky enough to get it. There are

now something like 46,000 wholly or partly unemployed on the local emloyment exchange register. This is nearly 20,000 more than there were within a week or two of the battleship work being put in hand. Immediately the "suspension" orders came, the number jumped up. It is not, of course, suggested that anything like 20,000 men in this district had been put on work directly concerned with the building of the contemplated new battleships, but there is at any rate a singular significance in the fluctuation of the unemployment figures. Earlier in the "slump" period Sheffield's unemployed army had reached the formidable total of 70,000, so that to-day's figures are not as bad as they might be.

A Coming Conference.

Reference to these "lost battleships" reminds me that there is called for next Tuesday a conference of civic representatives of those towns which have been badly hit by the pacific proposals emanating from Washington. The Lord Provost of Glasgow, the Lord Mayors of Sheffield and Newcastle, and the Mayors of Barrow, Wallsend and Jarrow are meeting to discuss the problem of providing alternative work, and it is suggested that the Prime Minister shall be asked to receive a deputation from this conference. No one wishes to prejudice any possible effort to alleviate the prevalent distress, but I cannot find in Sheffield, at any rate, any great enthusiasm for this project. Manufacturers here are asking what practical knowledge of the intricate problems of employment can these well-meaning civic dignitaries bring to bear on their deliberations. So far as Sheffield is concerned, its present Lord Mayor is a professional man, highly skilled as an accountant and with a genuine sympathy for the unemployed and an earnest desire to find a way out that none who know him will question. But he would have gone to the conference with far more hope of a successful outcome if he could have been accompanied by a few of the principal employers of labour from the city. After all, it is these latter who in the end will have to be consulted; why not in the first place? Road-making and sewer construction—which seems to be about the only kind of relief work that public authorities can think of—are of little use to a skilled or semi-skilled craftsman, and it is this class that forms a very considerable proportion of the unemployed here. Meanwhile, there are standing idle enormous steel-making and engineering plants, representing millions of capital, which might be turning out articles of utility of which the whole world stands in need. The problem awaiting solution is how to reconcile these anomalous conditions. Sheffield employers are not over-confident of the ability of the civic leaders to find this solution.

Armaments—at Home and Abroad.

Meantime, armament firms are finding it a very difficult and costly process to turn from war work, for which their enormously expensive plants are primarily adapted, to the productions required by a world at peace. Among the first to suffer in the process are the experts. In his recent speech at the annual meeting of Vickers' shareholders, Mr. Douglas Vickers foreshadowed this inevitable reduction, and with the passing of the old year a number of staff officials and workmen connected with the armament departments here were paid off. The work of designing and preparing plans and specifications for the suggested new ships of a different type is of too distant and uncertain a character to hold out any immediate hope. In any case, this preliminary work would occupy several months, and in the meantime there is nothing for the Sheffield staff and skilled workmen to do.

Encouraging Signs.

Even more encouraging than efforts to provide temporary relief for unemployed armament workers—and perhaps better than armament work itself, which is, after all, unproductive—are the few signs of a coming recovery in general trade conditions. For instance, there is just to hand news that the well-known Lincoln firm of Clayton and Shuttleworth has received an order from India for 20,000 iron castings of the aggregate weight of 1000 tons, which will keep the foundry employed for three months. Then one Sheffield firm at any rate—Edgar Allen and Co.—has shown a confidence in the return of normal conditions by its recent installation of two new types of furnace, both aiming at greater fuel economy, one by the utilisation of slack and other low-grade coal, and the other by the utilisation of producer gas. The slack and small coal is used by means of a turbo-pulveriser, which sends this cheap fuel into a couple of burners in a forge furnace. The producer gas furnace is of a new type, the main object of which is to obtain perfect annealing combined with greatly increased output. It has been installed for the production of high-grade steel castings. The furnace consists of three chambers—a pre-heating, an intermediate annealing, and a cooling chamber. The pre-heating and annealing are producer gas fired and the cooling chamber is slightly heated by a portion of the waste gases. Annealing to 900 deg. Cent. is done in the central chamber, which is provided with a continuous waste gas recuperator for pre-heating the secondary air to complete combustion. Producer gas flues are built along each side of the furnace, and mushroom valves with the ordinary columns are fixed for controlling the gas supply to each side of the pre-heating and annealing chambers, these flues being connected together underneath the cooling chamber to the main supply. Up to 25 tons have been annealed on each of the bogies per twenty-four hours. The intermediate chamber doors are of a novel construction, with cast iron and steel framework, suspended from rollers travelling on an overhead joist, supporting the whole structure. These doors are sealed overhead with sand seals across the furnace roof, the bottom of the doors sealing alternatively in each end of the bogies.

The Coal Situation.

The market for industrial fuels has not yet got properly settled down after the holiday interruptions. The fact that owing to the depressed condition of trade a number of industrial concerns had somewhat extended the holiday resulted in the collieries following this example, but by the middle of the present week work was resumed at most of the pits in this district. Stocks have been reduced of late, and orders are accumulating. Export business has been on a smaller scale, but there are a good number of inquiries on the market for forward deliveries, and it is expected that business will very soon expand considerably. It cannot be said that the market is any firmer, but there is a certain amount of selling pressure at special prices. The root of the trouble in respect of small fuel is that the demand for coke for inland purposes is so limited, owing to the small number of furnaces that are in blast. Up to a few weeks ago, the surplus of coke that was produced over and above inland requirements was readily disposed of for export. Recently this business has fallen off, with the result that coke is not moving so freely. Spot lots are offered at special rates in some cases, though for the most part quotations are unaltered. Although the reduction in rail rates is very welcome as a step in the right direction, the reduction so far as local quotations are concerned will only be effective to the extent of a few pence per ton. As a result of the ascertainment of the results for the division as a whole for the month of November, wages of workers in the industry will be increased by .32 per cent. for this month. This fractional increase will not affect working costs more than one or two decimal points per ton. Wages in this area are roughly 110 per cent. on the basis rates of 1911, while in the Lancashire area the percentage on the base is only 72, and with the greatly increased cost of production this area finds it difficult to compete against Lancashire. Some of the South Yorkshire colliers seem to be fulfilling the big expectations created by their equipment of the most up-to-date appliances for facilitating output. According to Mr. Charles Markham, chairman of the Staveley Coal and Iron Company, the Parkgate Iron and Steel Company and many other large industrial concerns in South Yorkshire and Derbyshire, a group of four of his companies' collieries in the new South Yorkshire coalfield—Brodsworth, Bullcroft, Hickleton and Yorkshire Main—had in the last week of the old year the remarkable output of 97,000 tons. This is probably a record. It may be recalled that a few weeks ago Mr. Markham made the sporting offer to hand over to the colliers for six months the working of certain of his Derbyshire pits, which he says are unremunerative at present wage rates, provided the miners would indemnify his company against loss. This challenge was not taken up; meantime there are over 2000 miners in Derbyshire out of employment.

Sheffield's New Knight.

Sheffield people of all classes have showered sincerest congratulations upon Mr. Albert John Hobson, who, it is universally admitted, has abundantly earned his knighthood by his long career of unstinted public service. His pre-eminence in the sphere of industrial finance, particularly in relation to the steel and engineering trades, has been recognised not only in this country, where he recently held the presidency of the Association of Chambers of Commerce, but on the Continent and in America, where he has been entrusted with various commercial missions of importance and delicacy. As vice-chairman and one of the founders of the High-speed Steel Alloys, Limited, he played a foremost part in freeing British industry from the German monopoly in tungsten, one of the essential ingredients of high-speed steel.

NORTH OF ENGLAND.

(From our own Correspondent.)

An Extraordinary Trade Reversal.

THE year 1921 will go down in history as one of the most disastrous so far as the North of England industries are concerned. The transition from great prosperity to acute depression came with extraordinary rapidity. Production in almost every section of trade fell to the lowest ebb recorded for several decades, and the collapse in prices was without precedent. The iron and steel trades have passed through many vicissitudes, but no more difficult period has been experienced than that of the past twelve months. It was the inflation of values which in the first instance was responsible for the slump. Prices had reached an impossible level. With depleted exchanges foreign consumers were simply unable to pay the prices for our iron and steel, and in consequence there was an almost complete surrender of our overseas trade. That, however, did not mark the full extent of the blow at our industrial prestige. Cleveland not only lost its overseas markets, which in pre-war days represented a trade of about three-quarters of a million tons of pig iron per annum, but, in addition, the home markets were invaded, and for months the Cleveland ironmasters had the tantalising experience of witnessing a constant stream of pig iron pouring into North-East Coast ports from the Continent, whilst their own blast-furnaces were standing idle. In fact, the imports of pig iron from abroad to the Tees alone during the four months, August, September, October, and November, exceeded the total exports from the Cleveland district for the whole year. At the beginning of the year a slump in the iron and steel trades had already set in, but there was no doubt that the depression was rendered deeper and more rapid by the ill-advised action of the coal miners in their declaration of industrial war, involving, as it did, the complete closing down of industry for four months. Even after the miners got back to work again and fuel was once more available very little pig iron was produced on the North-East Coast, and in November, which is the last month for which the figures of production are available, the total output of pig iron was less than half the quantity produced before the coal strike. The furnaces in blast at the end of the year on the North-East Coast numbered twenty-three, whereas at the beginning there were seventy-two in operation.

Production of Pig Iron.

It is estimated that the output of pig iron on the North-East Coast for the past year will probably be found to have been about 1,071,500 tons, as against 2,626,700 tons in 1920, while the output of ore from the Cleveland mines is not expected to exceed a million tons or little more than a quarter of the previous year's total. Various causes, internal and external, have precipitated this collapse, but there is no doubt that the question of price was the most serious. The operation of the international exchanges told heavily against the British pig iron manufacturers, and they were completely thrust out of the continental markets. Not only that, but the foreign producers were enabled to send their iron over here in considerable quantities at a price pounds below that of the home product. Indeed, the North-East Coast steel makers themselves, though in most cases owning their own blast-furnaces, preferred to keep their furnaces idle and to use foreign pig iron and scrap in their steel furnaces rather than face the high costs of production involved in smelting their own pig iron. The great problem for the Cleveland makers has therefore been to reduce the inflated costs of production and their prices for pig iron. In this direction remarkable results have been achieved. The ironmasters have devoted themselves unceasingly to the task, and in so far as they can control events they have succeeded. They are very near a competitive level, and the best opinion is that the New Year will speedily witness the long-looked-for revival in the home trade. Labour has willingly co-operated by accepting most drastic wage cuts. But the two biggest items in the bill of costs are railway rates and fuel, and in neither case has there yet been afforded that relief which the manufacturers have a right to expect. During the year the price of No. 3 Cleveland pig iron fell from 225s. to 100s. per ton, a drop of over 56 per cent., but a further reduction seems imperatuve to a revival in trade, and it is in the direction of lower railway and fuel rates that makers are now looking for relief to enable them to effect the decrease.

Manufactured Iron and Steel.

The output of manufactured iron and steel on the North-East Coast also reached a very low ebb, the estimated total for the year being just over 1,000,000 tons, as against 1,958,000 tons in 1920. Throughout most of the year the steel makers were only able to keep their plants going intermittently. Many were closed entirely following the coal strike, others were merely kept in partial operation, and the makers accustomed to huge contracts were glad to book small orders, which involved constant changes in the rolls and destroyed all hope of profit on the transaction. The shipbuilding slump hit the steel trade hard, for the manufacture of shipbuilding material is an important branch of the trade. From the shipyards there was a steadily waning demand, and the plate makers had, moreover, to face the fact that foreign plates were being offered at pounds per ton below the price of the home-produced article. As in other branches of trade, the difficulties created by the collapse of foreign credit and the depreciation of the currencies were serious. But the steel makers faced the situation with courage, and are now within sight of success. Ruthless cuts were made in the costs of production. Wages were cut as in no other trade and profits were entirely sacrificed. The position is now hopeful, for in many directions makers can successfully compete with continental producers. The appended list shows the remarkable reductions which took place in steel prices during the year:—

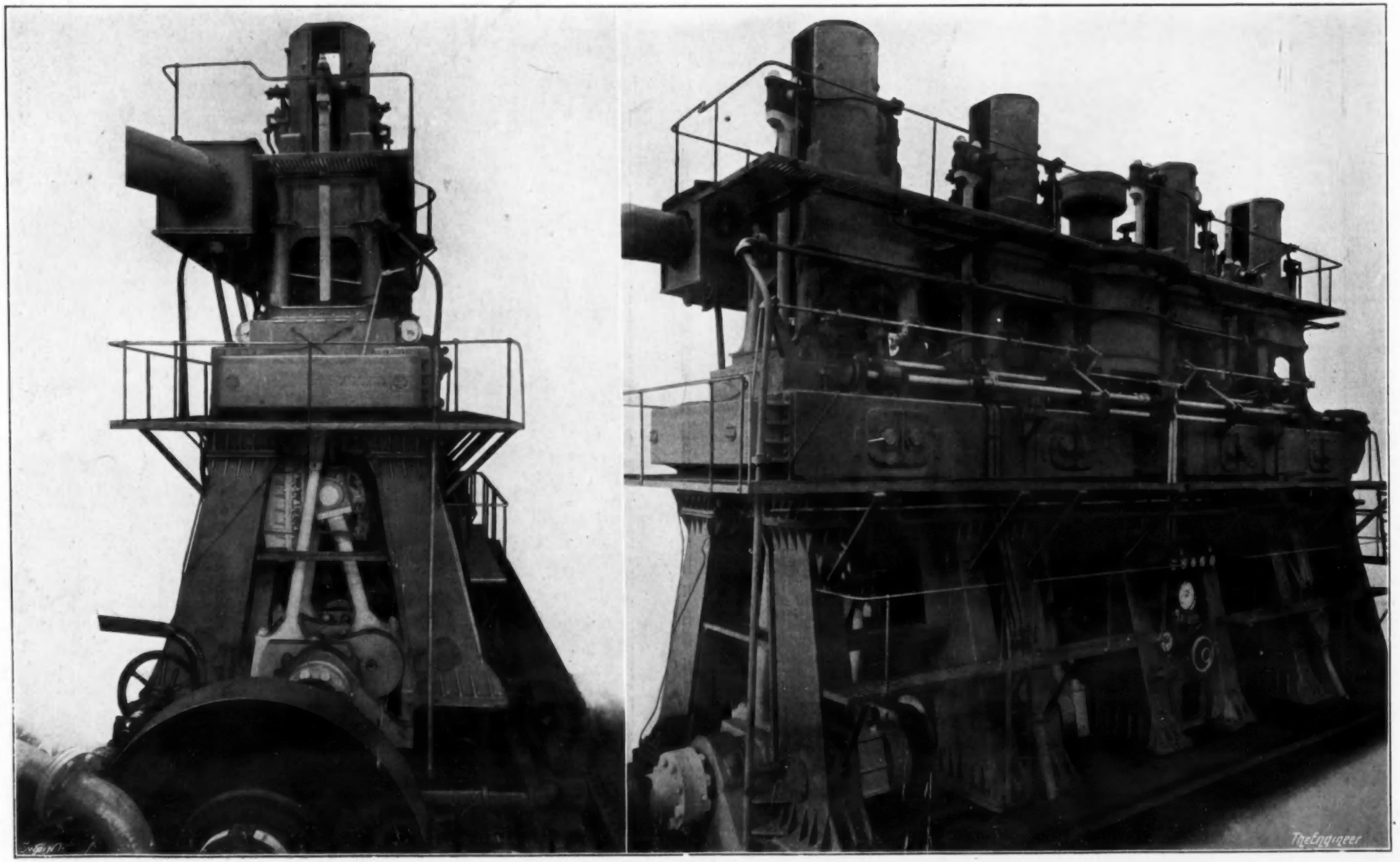
	January 1st. £ s. d.	December 31st. £ s. d.
Steel boiler plates	29 10 0	16 0 0
Steel ship plates	24 10 0	10 10 0
Steel angles	24 0 0	10 0 0
Steel joists	24 0 0	10 10 0
Heavy steel rails	25 0 0	10 10 0
Billets (medium)	23 0 0	9 0 0
Billets (hard)	24 0 0	9 10 0

Iron and Steel Exports.

The year was a most disastrous one for the iron and steel export trade. Not only did we lose our markets abroad, but the foreign makers undersold us in our home market, and for the first time in the history of the trade the imports of pig iron exceeded our exports. The foreign shipments of pig iron from the Cleveland district amounted to 68,000 tons for the year, whilst the imports exceeded 100,000 tons. It is believed that the corner has been turned and that this flow of iron from abroad will rapidly dry up. But it has meant idle furnaces and great distress amongst the workers of the Cleveland district. On the other hand, Cleveland's imports of manufactured iron and steel, which in the year 1913 totalled 23,908 tons, only reached about 20,000 tons last year, and the semi-steel imports—billets, blooms, &c.—which in 1913 totalled 49,827 tons, fell to about 38,000 tons. Our foreign trade in steel was, in fact, the mainstay of the industry, for at a time when the home demand reached its lowest ebb, owing in no small measure to the shipbuilding slump, and the general disposition to wait for lower prices, the foreign demand was well maintained. British overseas Dominions gave loyal support to the home industry, and chiefly by reason of this fact the foreign steel exports from Cleveland for the year amounted to 285,000 tons, or about the same as those for the previous year. There was not much variation in the coastwise shipments of iron and steel manufactures, but the pig iron shipments were only about 30 per cent. of those of 1920. The grand total of exports of pig iron, manufactured iron and steel was 449,362 tons, as against 750,570 tons in the previous year.

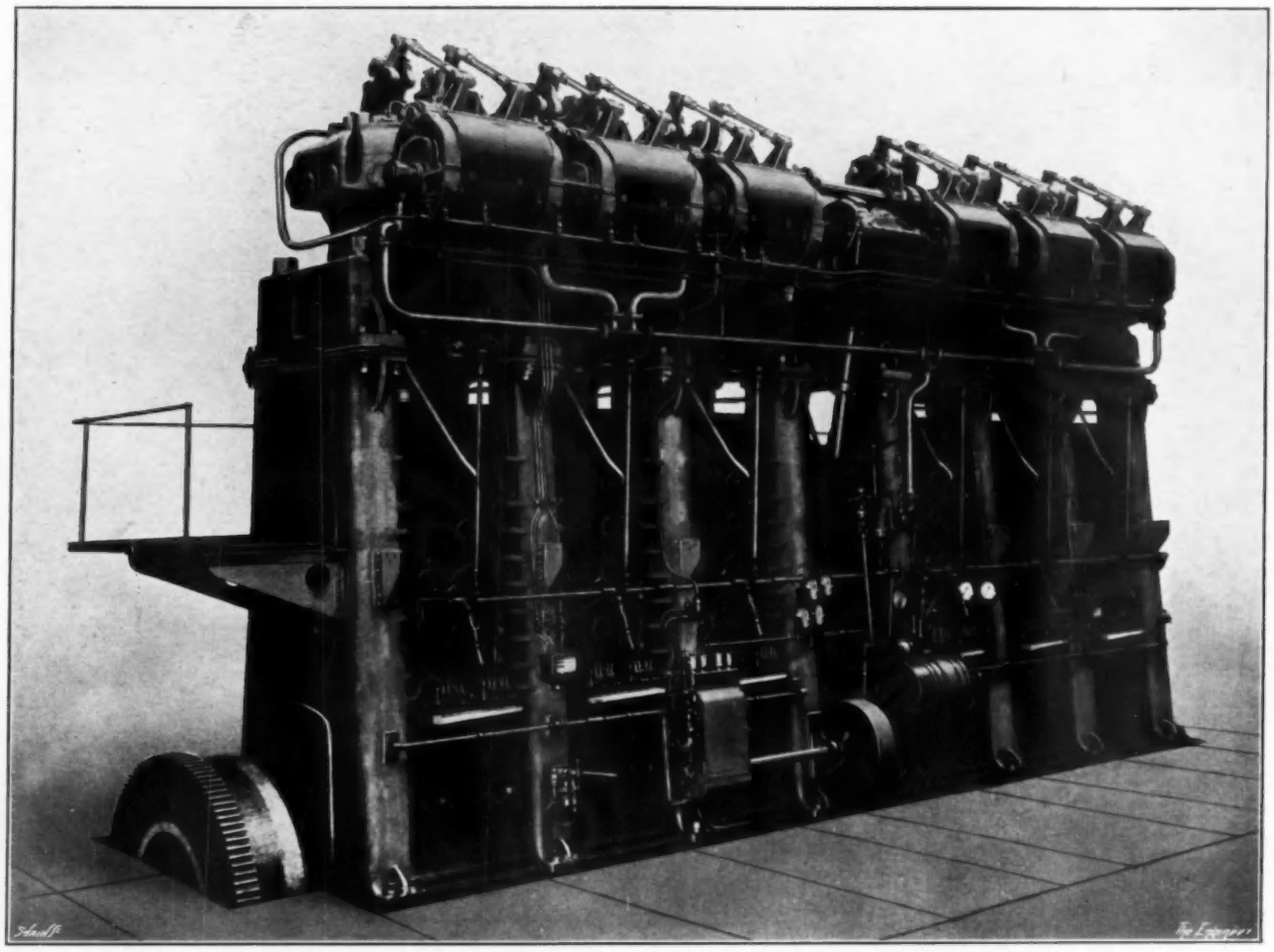
Current Business.

The Cleveland iron and steel market has reopened after the holidays, but little or no business has been recorded. There has been no meeting of the Ironmasters' Committee, so that the generally expected revision of prices has yet to be effected. The outlook for the trade is regarded as brighter by reason of the increasing number of inquiries for iron, and it is only the relatively high price of Cleveland foundry iron that holds up business. It is believed that a 10s. cut would lead to the placing of substantial orders. In regard to hematite, business has already improved, and substantial orders are said to have been placed, with the result that continuity of work at the furnaces on the North-East Coast is now assured. All the steel works are closed and prices of manufactured iron and steel remain unchanged.

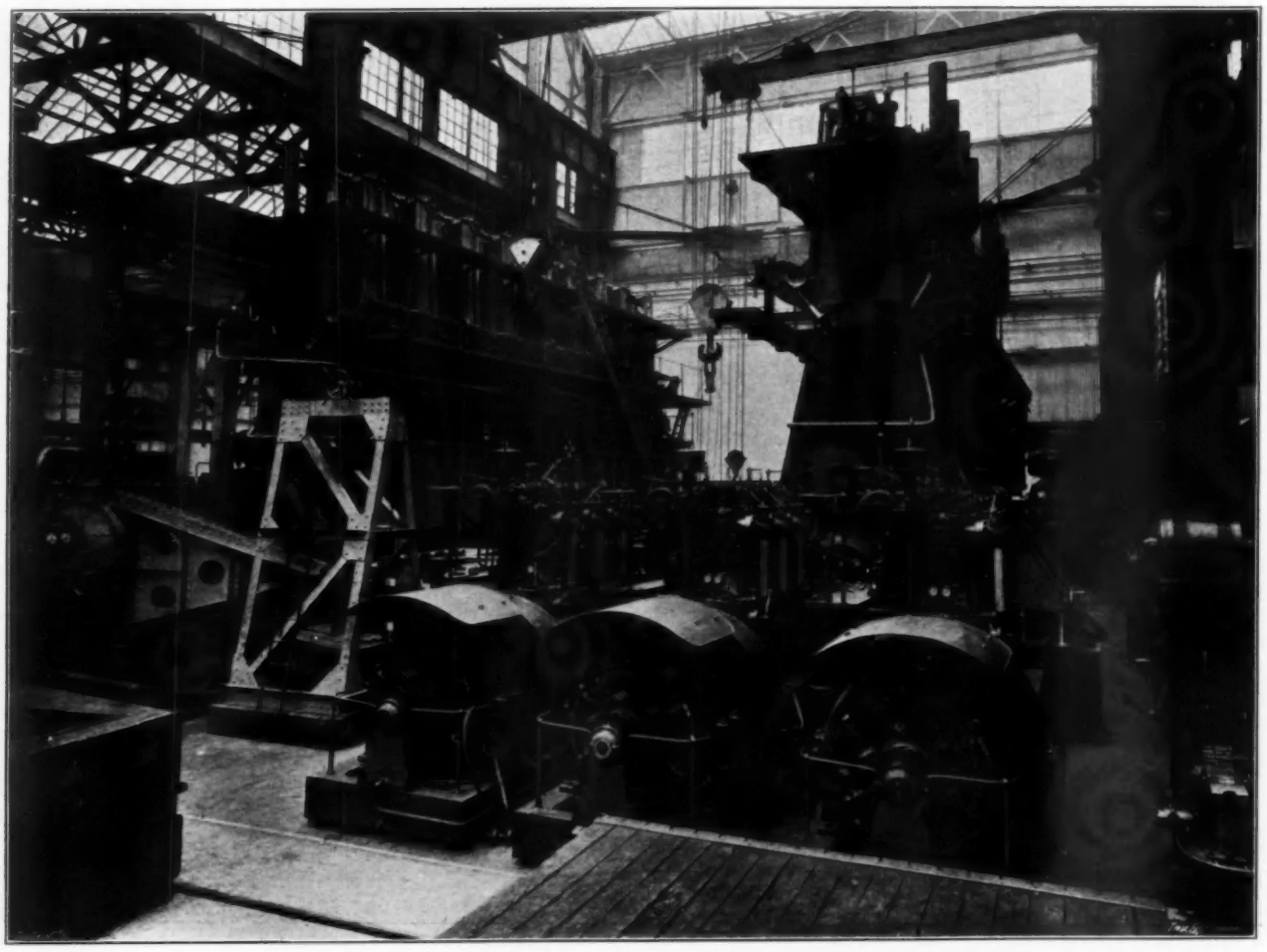


3000-I.H.P. OPPOSED-PISTON ENGINE—WM. DOXFORD AND SONS

MARINE OIL ENGINES OF 1921

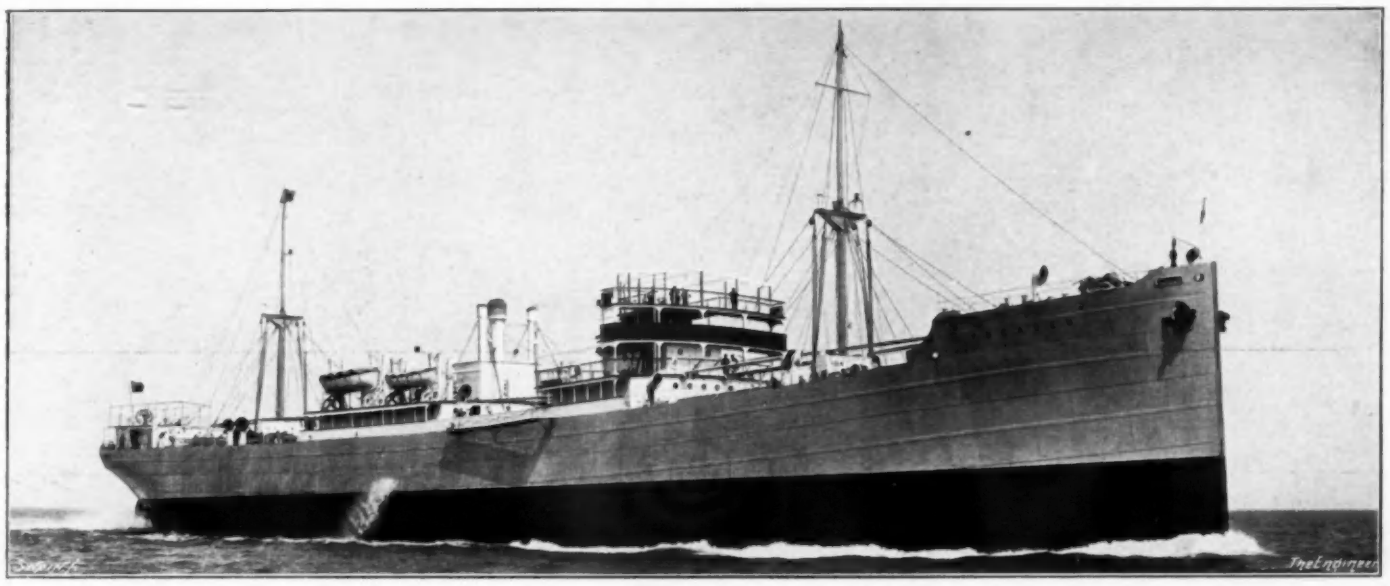


1250-I.H.P. ENGINE AS FITTED IN THE SEMINOLE AND OTHER MOTOR SHIPS—VICKERS LIMITED

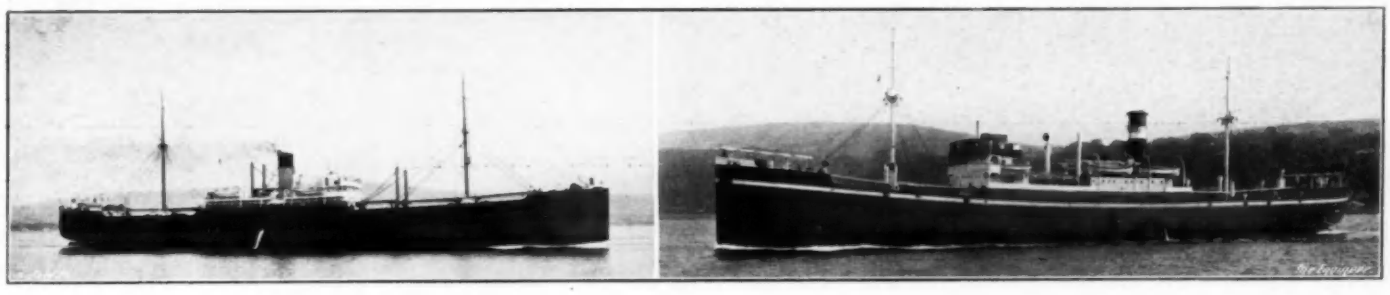


PORT AND STARBOARD ENGINES OF THE MOTOR SHIP GLENOGLE—HARLAND AND WOLFF

SOME MOTOR SHIPS OF 1921

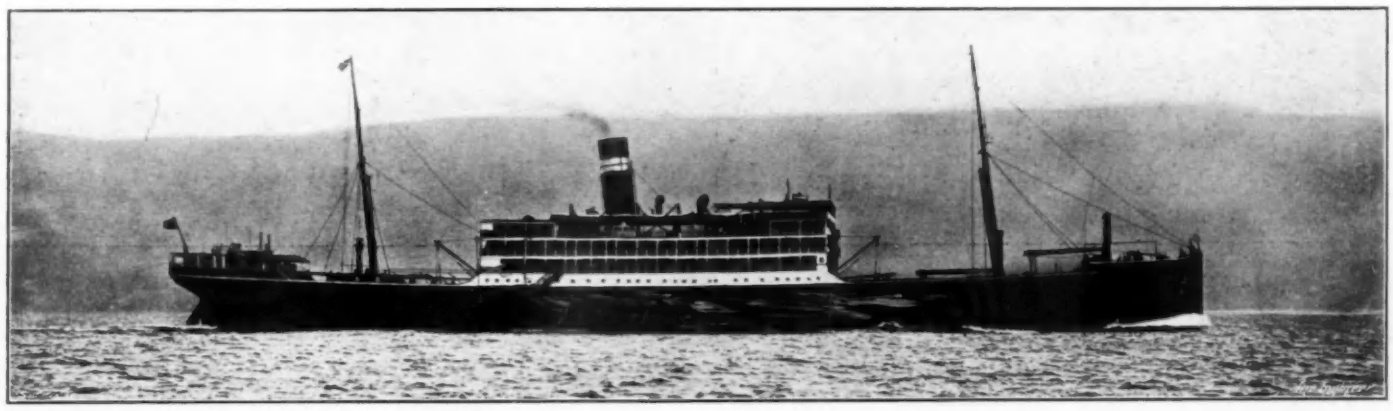


THE YNGAREN

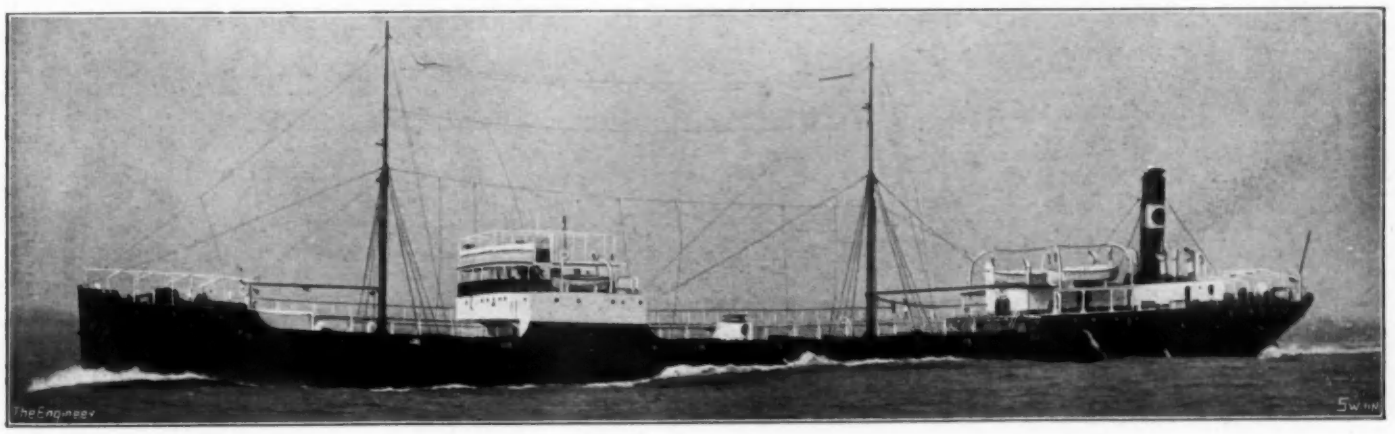


THE DORSETSHIRE

THE MALIA

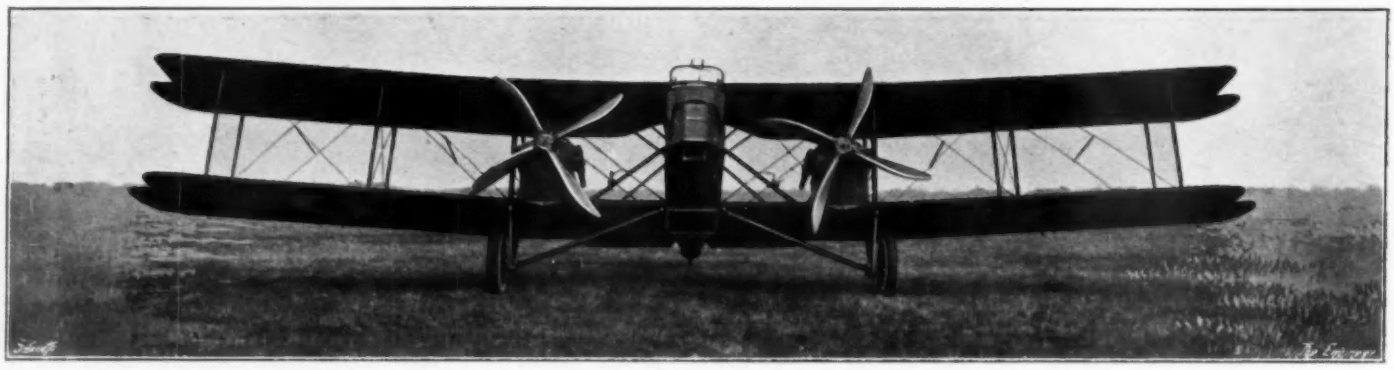


THE DOMALA

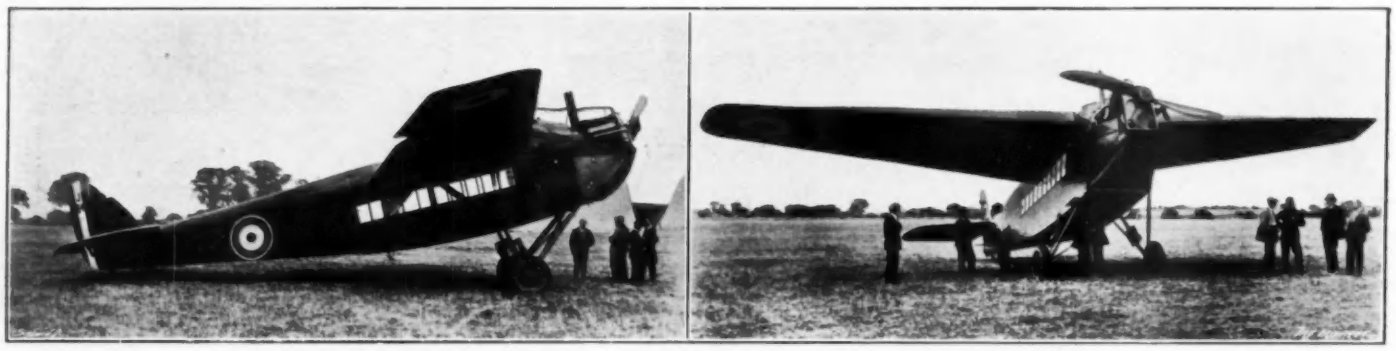


THE TANKER CONDE DE CHURRUCA

SOME BRITISH AEROPLANES OF 1921



BOULTON AND PAUL LONG-DISTANCE RECONNAISSANCE MACHINE



DE HAVILLAND TWELVE-SEATER MONOPLANE WITH CANTILEVER WINGS

WESTLAND WALRUS NAVAL SPOTTING MACHINE

MARS I. SINGLE-SEATER RACING MACHINE

BRISTOL TEN-SEATER COMMERCIAL MACHINE

The Coal Trade.

There is little to record in the Northern coal trade situation, which, owing to the holidays, has been more or less nominal as regards actual trading. With regard to the outlook, the tone is decidedly more cheerful and optimistic. At the moment the forward market is very quiet. Most of the buyers for abroad are still holding off, and while a few deals have been placed over the major portion of the year, business for 1922 is still to be settled. Foreign buyers are hoping for lower prices than those now ruling. In the meantime the majority of the collieries in both Northumberland and Durham are in a fair position for the month of January, and are inclined to hold for current figures all round.

Coal Miners' Big Wage Reduction.

The accountants' ascertainment on the state of the coal mining industry in Northumberland shows that the percentage on the basis wages for January will be 85.76 per cent., as compared with 107.35 in December. This means a further reduction to the higher grades of labour at the pits of from 10d. to 1s. per shift, and from 7d. to 8d. per shift for the lower-paid men. Wages in the county are now only 23.84 per cent. above the wages ruling in 1914.

SCOTLAND.

(From our own Correspondent.)

New Year Holidays.

THE past few days have been practically a blank owing to the New Year holidays, and only in the case of the coal trade will an early re-start be made.

No Change.

The general situation in industrial circles remained unaltered during the closing days of 1921, and the end came as a general relief. With the coming of the New Year hope is renewed, and while general prospects are none too bright, indications of better things are not altogether lacking.

A Short Review.

The troubles and difficulties which beset the industrial world during the year 1921 are thoroughly well known, and anything more than a passing reference would be superfluous. High costs, severe foreign competition, and the coal strike combined to produce a state of affairs practically without precedent in modern times, or perhaps even in any time. In the coal trade alone has there been any recovery from the disaster which befel industrial circles generally. In the steel and iron trades it has been a continued story week by week of lack of trade, despite all efforts to revive interest. The hands of local producers were tied by high oncosts, and even though prices lower than cost were quoted, no increase in turnover could be brought about. Steel prices have dropped 50 per cent. without making any material difference, and unemployment has been rife. In the latter half of the year prices were "freed," and since then Scottish makers have experienced keen competition from English sources, where prices have been quoted considerably below the Scotch price for local delivery. The extent of the drop in prices may be seen from the fact that while in January, 1921, boiler-plates were £31 10s. and sections £24 10s. per ton, the figures in December were £14 and £10 per ton respectively. In the same period steel sheets dropped from £29 to £12 10s. per ton. It is estimated that the output of bar iron did not average more than 30 per cent. of the capacity and many workers have had months of idleness. Here, again, prices dropped without bringing any lasting benefit. In the twelve months Crown bars were reduced from £27 10s. to £12 10s. per ton. The depression has been severely felt in the hematite trade. Only some three furnaces were producing hematite after the coal strike, and even these were recently put out of blast again. Even with hematite at £6 per ton, a decrease of £7 10s. since January, 1921, no business was coming forward. Foundry pig iron has been hardly any better off. Business decreased rapidly from the beginning of the year until the coming of the coal strike. Thereafter, some eighteen furnaces were re-lit, only to be reduced to nine later on, the latter number being now in operation out of over one hundred furnaces in existence. To-day's price for No. 1 foundry is £6, and No. 3, £5 15s. per ton compared with £13 5s. and £13 per ton respectively in January, 1921. During the last two months of 1921 there was a welcome spurt in the Scotch export coal trade. Many orders were received from Scandinavia, France, and Italy, and the rush was unprecedented for the season of the year. The improvement has continued, and at the time of writing quite a good number of steamers are in the various ports awaiting cargoes. Cheaper prices and easier freights have been of immense value in the re-opening of these markets, lost for a season to foreign competitors. The home trade, however, is in a poor state owing to continued local industrial depression. Outputs are increasing gradually, however, and the trade will at the present rate soon be in a position to cope with any increased demand that may arise through a betterment of the general situation at home.

Prospects.

Prospects are of necessity obscured, but there seems reason to anticipate an improvement in trade generally throughout the year 1922. Buyers are becoming more convinced of the genuine desire of manufacturers to do all in their power to meet the situation, and indications of movement in various directions are not lacking. Inquiries for steel are increasing, and rumours of shipbuilding orders are prevalent. Oncosts are decreasing, and competition from abroad is much less in evidence. General freights are also much easier, and if the Scottish railways can see their way to make concessions along the lines suggested by traders, the outlook will be considerably brightened. As matters stand at present the forward movement is decidedly in its infancy, but the general trend of the markets is undoubtedly in the direction of steadiness and renewed confidence.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

"The Coming Storm."

WITHOUT taking things too seriously, it is impossible to ignore recent events in the coalfield of this district which point to the relations between the employers and labour becoming strained instead of more harmonious in the near future. The attitude of the new president of the South Wales Miners' Federation has already been referred to as rather menacing the peacefulness of the coalfield, and it is unfortunate that the hostility displayed towards the owners appears to be becoming more pronounced. Acting upon the advice of Mr. Vernon Hartshorn, the miners in the Maesteg district have tendered notices to terminate their engagement on Monday next, the allegation being that men in that district had been dismissed because they had claimed the minimum wage, while further it is contended that allowances and bonuses which men have been receiving for years past have been stopped. Other leaders aver that there is ground for similar complaints in other parts of the coalfield, and that now that the coalowners have the whip hand they are using it with a vengeance. What truth there is in all this it is impossible to say. The coalowners' side of the question has not yet been heard, but doubtless the serious indictment which the president of the Federation has drawn up against the coalowners will be answered in due course, though it is advisable that this answer should not be delayed in view of the trouble that may be occasioned in the meantime. Mr. Hartshorn is undoubtedly doing his utmost to discredit private ownership, and in an article in which he refers to the "coming storm," he states that he is quite satisfied that the present condition of the workmen of the Welsh coalfield is largely due to the cut-throat competition which is going on among the South Wales coalowners themselves and between the South Wales coalowners and those of the other British coalfields. He charges the coalowners of this country with being directly responsible for much of the misery and ruin that have fallen on the home life of hundreds of thousands of miners. Other leaders have adopted the cue of Mr. Hartshorn, and are advising the men to "be prepared." The workmen are now being told that America has been beaten out of the markets of Europe, that the only competition existing is among the coalowners themselves, and that they are deliberately cutting prices in order to keep down the wages of the miners to the minimum. Such allegations as the above are based on complete ignorance of the commercial conditions prevailing. It is quite true that competition, so far as America is concerned, is negligible, but competition with French, Belgian, Spanish, and more particularly German coals is a very real fact. What the miners' leaders apparently want is for coals to stand at higher prices in order to improve the percentage on the wage rates of the workmen; but one thing is certain, that, as trading conditions are, if prices go up, then our exports will go down and so will employment diminish. The men cannot have it both ways. At one time the cry was that the high price of coals, which was responsible for preventing industry in genera from reviving, was the fault of private ownership. Now that prices have fallen, the miners are equally dissatisfied, and the owners still get their full meed of blame.

Italy's Coal Requirements.

Recently currency was given to the report that the Italian Government was stopping the taking of Welsh and American coals, and that it was proposed to close the Italian State Railway Agency at Cardiff. The reason given was that German reparation coal was sufficient to meet their requirements. It has been known for some time past that little or no American coal would find its way into Italy, but the report that Welsh coals were to meet the same fate naturally caused some interest. Inquiries show that the report is not altogether correct. It is true that further buying on the part of the Italian authorities may be withheld for some time, but there are arrears on contracts to be lifted, and they may be glad of these to help work the German coals off. As for closing the Cardiff agency, this is officially denied.

Iron, Steel and Tin-plate Items.

Mr. F. R. Hann has been appointed general manager of the Ebbw Vale Steel, Iron and Coal Company and its associated undertakings, in succession to Mr. A. B. Sweet-Escott, and commenced his duties on the 2nd inst. Mr. Hann is a son of Mr. E. M. Hann, director of the Powell Duffryn Company, of which he was for many years the general manager. Another appointment of interest is that of Mr. William Simons as the general manager of the Cardiff-Dowlais iron and steel works owned by Guest, Keen and Nettlefolds, Limited. Mr. Simons, who will not take up his new duties for some months, is the managing director of the Shelton Iron, Steel and Coal Company, of Stoke-on-Trent, and is a director of several undertakings. He has previously had experience of South Wales, as he formerly held an appointment at the Cardiff-Dowlais works, and left this district twenty years ago to join the Shelton Company. The announcement that South Wales tin-plate workers have secured an order for 50,000 boxes for Japan in competition with the Americans is interesting news. The order will be divided among the different works in this district. The position in the tin-plate industry is not quite so good as it was a few weeks ago, as many orders have been worked off and others will be completed shortly. Merchants are offering plates at 20s. per box, which is below the cost of manufacture. It is officially announced that Baldwins, Limited, have completed the purchase of the Eagle Tin-plate Works, and the old directors, of whom Mr. F. W. Gibbins was the chairman, have retired, the new directors being Sir John Roper Wright (chairman), Sir Richard Vasser Vasser-Smith, Sir W. Charles Wright, and Mr. John Cecil Davies. The Eagle works were erected in 1890–1891, and have had a very successful career. The new manager is Mr. James Richings, who for many years was secretary and assistant manager under the old company

Blaenavon Linking-up.

The interesting announcement is made by the Blaenavon Company, Limited, that as Mr. Chalinder Evans, the manager of its Cardiff office, is retiring from business the opportunity is being taken for some alteration in the organisation, and as from the 1st inst. the selling of all coal for export and inland (except the Abergavenny agency) and the purchase of their pit-wood requirements has been concentrated in their Cardiff office, and an arrangement has been come to with the Maris Export and Trading Company, Limited, to manage this office. This, in effect, means the linking up of the powerful Powell Duffryn Company with the Blaenavon Company, as the Maris Company is an offshoot of the Powell Duffryn Company. The Maris Company was registered in November, 1920, with a capital of £250,000. The Blaenavon Company has an output of about 800,000 tons.

Current Business.

Actual business has been more conspicuous by its absence since writing a week ago. The holidays have been responsible for inactive conditions, but apart from this, it cannot be said that the inquiry from abroad has been by any means brisk. Buyers appear to be holding their hands for the moment, probably waiting to see how things go. In the meantime the coal market has been upset considerably by the heavy gales which have been prevailing, and which have played havoc with the movement of tonnage and the loading arrangements of collieries. The result is that the tone of the market is not as steady as it at one time looked like being; but still colliery salesmen are not cutting their prices to any substantial extent, as working costs will not permit this. Best Admiralty large are about 25s. to 25s. 6d., and best steam smalls are 18s. to 19s. With regard to contract operations, there is no news of a definite character respecting the inquiries from India, Brazil, the Argentine, &c., but it is reported that one well-known firm has contracted to supply 150,000 tons of steam coals for Far Eastern destinations for shipment over a period of some months, but precise particulars have not been disclosed.

Latest News from the Provinces.

WALES AND ADJOINING COUNTIES.

Swansea Metal Exchange.

THE tin-plate market is easier, and shows a fall of 1s. 6d., box plates being quoted at 19s. 3d. per box. This compares with £4 per box during the war boom and 12s. 6d. pre-war. Many works are far from being well placed for orders, and some are on the verge of coming to a standstill. Prices in the galvanised sheet market are easier, £16 10s. f.o.b. being now offered for 24 gauge corrugateds in bundles.

Miners' Wages.

There is no change in the wage rates of South Wales miners for January. The ascertainment of the figures for the past month shows that the workmen are entitled to 12.11 per cent. on the 1915 standard, but under the wages agreement the wages are guaranteed at 20 per cent. above the wages of 1914, which is equivalent to 28 per cent. above the 1915 standard. The wages for January will therefore be 28 per cent. above the 1915 standard, and the difference will be made up out of the proportion of profits to which the owners are entitled.

CEMENT MANUFACTURE IN BRITISH MALAYA.

REPORTING on the advisability of encouraging the local manufacture of cement in British Malaya and the best means of doing so, a committee composed of officials and others favours the proposal. It appears from expert evidence, it is stated in the report, that in British Malaya there is an unlimited supply of excellent material available for the local manufacture of a high-grade cement, yet not 10 per cent. of the country's requirements is produced locally. In view of the great demand, which will be maintained for some considerable period, it appears to the committee that the non-development of the cement industry is economically regrettable. In 1914 a cask of English Portland cement cost 4.26 dols. c.i.f. Port Swettenham. To-day the same cask would cost at least 13 dols. This fact might appear in itself sufficient inducement for private enterprise to take up and develop the local manufacture of cement, but unfortunately the cost of buying and setting up in Malaya an efficient and economical plant is at the present time so great that any private company doing so would have to run the risk of finding itself seriously over-capitalised if and when prices revert to normal. The committee is of the opinion that the Government should assist in the establishment of the cement industry on a firm economic basis. In this connection two facts have to be borne in mind. In the first place, small-scale production is not economical. The only really economical plant, it is asserted, is one capable of producing at least 30,000 to 40,000 tons per annum. In the second place, with a modern, up-to-date plant, very little labour is required for cement manufacture. To encourage the local production of cement on a large scale, the committee suggests that the best means would be for the Government to undertake to fulfil all Government requirements of cement by local purchase from the company installing the necessary plant of approved capacity, at a guaranteed minimum price for cement of an approved standard of quality; and that the price should be one, variable with altering circumstances, and based on the actual cost of production, plus a fair percentage for profit.

Current Prices for Metals and Fuels.

IRON ORE.

N. W. COAST—	
Native	37/-
(1) Spanish	28/-
(1) N. African	28/-
N.E. COAST—	
Native	—
Foreign (c.i.f.)	26/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	6 0 0	—
No. 1 Foundry	6 0 0	—
No. 3 ,,	5 15 0	—
N.E. COAST—		
Hematite Mixed Nos.	5 0 0	5 0 0
No. 1	5 2 6	5 2 6
Cleveland—		
No. 1	5 5 0	5 10 0
Silicious Iron	—	—
No. 3 G.M.B.	5 0 0	5 5 0
No. 4 Foundry	4 15 0	4 15 0
No. 4 Forge	4 10 0	4 10 0
Mottled	4 5 0	4 5 0
White	4 5 0	4 5 0
MIDLANDS.		
Staffs.—		
All-mine (Cold Blast)	15 0 0	—
Part Mine Forge	*None offering.*	
North Staffs. Foundry	5 5 0	—
(3) Northampton—		
Foundry Nos. 2 and 1	*Nominal.*	
,, No. 3	4 12 6	—
,, Forge	4 2 6	—
(3) Derbyshire—		
No. 3 Foundry	4 10 0 to 4 12 6	
Forge	4 5 0	—
Lincolnshire—		
Basic	*Uncertain.*	
Foundry	,,	—
Forge	,,	—
(4) N.W. COAST—		
N. Lancs. and Cumb.		
Hematite Mixed Nos.	6 5 0	—

MANUFACTURED IRON.

	Home. £ s. d.	Export £ s. d.
SCOTLAND—		
Crown Bars	12 10 0	—
Best ,,	17 0 0	—
N.E. COAST—		
Common Bars	12 10 0	—
Marked ,,	18 0 0	—
Tees	14 10 0	—
LANCS.—		
Crown Bars	13 0 0	—
Hoops	16 5 0	16 0 0
S. YORKS.—		
Crown Bars	13 0 0	—
Best ,,	14 0 0	—
Hoops	16 0 0	—
MIDLANDS—		
Marked Bars (Staffs.)	16 0 0	—
Crown Bars	12 0 0 to 13 0 0	
Nut and Bolt Bars	12 0 0 to 12 10 0	
Gas Tube Strip	13 10 0	—
Hoops (*Nom.*)	16 10 0	—

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	14 0 0	—
Ship Plates ¾in. and up	10 10 0	—
Sections	10 0 0	—
Steel Sheets ⅛in. to ¾in.	12 5 0	—
Sheets (Gal. Cor. 24 B.G.)	—	17 0 0

STEEL (*continued*)

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	10 10 0	—
Angles	10 0 0	—
Boiler Plates	16 0 0	—
Joists	10 10 0	—
Heavy Rails	9 10 0	—
Fish-plates	14 10 0	—
Channels	14 10 0	—
Hard Billets	9 10 0	—
Soft Billets	7 10 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	11 0 0	—
Light ,,	13 0 0 to 15 0 0	
Billets	9 10 0	—
Ship Plates	10 10 0	—
Boiler ,,	16 0 0	—
MANCHESTER (*Prices irregular and uncertain, unchanged*)—		
Bars (Round)	10 0 0 to 12 0 0	
,, (others)	11 0 0 to 12 0 0	
Hoops (Best)	15 5 0	15 0 0
,, (Soft Steel)	12 5 0	12 0 0
Plates	£10 to 12	10 0 0
,, (Lancs. Boiler)	16 0 0	—
SHEFFIELD—		
Siemens Acid Billets	11 0 0 to 13 0 0	
Bessemer Billets	12 0 0	—
Hard Basic	10 0 0	—
Soft ,,	8 0 0 to 9 0 0	
Hoops	12 5 0	—
Soft Wire Rods	11 0 0	—
MIDLANDS—		
Small Rolled Bars	10 0 0 to 10 10 0	
Bessemer Billets	7 10 0 to 8 0 0	
(2) Hoops	12 0 0 to 12 10 0	
Gas Tube Strip	10 15 0 to 11 0 0	
Sheets (24 W.G.)	15 0 0	—
Galv. Sheets (f.o.b. L'pool)	17 0 0 to 18 0 0	
Angles	10 0 0	—
Joists	10 10 0	—
Tees	11 0 0	—
Bridge and Tank Plates	10 10 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	19/3 to 20/3
Block Tin (cash)	168 12 6
,, (three months)	170 10 0
Copper (cash)	65 17 6
,, (three months)	66 15 0
Spanish Lead (cash)	24 7 6
,, (three months)	24 5 0
Spelter (cash)	27 7 6
,, (three months)	27 12 6
MANCHESTER—	
Copper, Best Selected Ingots	69 10 0
,, Electrolytic	74 10 0
,, Strong Sheets	98 0 0
,, Loco Tubes	0 1 2½
Brass Loco Tubes	0 1 0½
,, Condenser	0 1 4½
Lead, English	26 0 0
,, Foreign	24 10 0

(*Metal prices practically unchanged*).

FERRO ALLOYS.

(*All prices now nominal*).

	Per Ton.	Per Unit
Tungsten Metal Powder	1/8 per lb.	
Ferro Tungsten	1/6 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£28	12/-
,, 6 p.c. to 8 p.c. ,,	£26	10/-
,, 8 p.c. to 10 p.c. ,,	£26	10/-
,, Specially Refined		
Max. 2 p.c. carbon	£79	28/-
,, 1 p.c. ,,	£94	32/-
,, 0·75 p.c. carbon	£110	41/-
,, carbon free	2/8 per lb.	
Metallic Chromium	5/6 per lb.	
Ferro Manganese	(per ton) £18 for home.	
,, Silicon, 45 p.c. to 50 p.c.	£12 10 0 scale 5/- per unit	
,, ,, 75 p.c.	£20 0 0 scale 6/- per unit	
,, Vanadium	21/- per lb.	
,, Molybdenum	9/- per lb.	
,, Titanium (carbon free)	1/6 per lb.	
Nickel (per ton)	£180	
Cobalt	14/6 per lb.	
Aluminium (per ton)	£110 to £120 (British Official).	

FUELS.

SCOTLAND.

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	24/-
,, ,, Ell	25/-
,, ,, Splint	25/- to 30/-
,, ,, Trebles	26/-
,, ,, Doubles	24/-
,, ,, Singles	18/6
AYRSHIRE—	
(f.o.b. Ports)—Steam	24/-
,, ,, Splint	26/-
,, ,, Trebles	25/6
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	20/6 to 25/-
Screened Navigation	28/-
Trebles	26/-
Doubles	24/-
Singles	18/6
LOTHIANS—	
(f.o.b. Leith)—Best Steam	24/-
Secondary Steam	23/6
Trebles	26/-
Doubles	24/-
Singles	18/-

ENGLAND.

(8) N.W. COAST—	
Steams	34/-
Household	40/- to 55/-
Coke	34/- to 36/6
NORTHUMBERLAND—	
Best Steams	24/- to 25/-
Second Steams	21/6 to 22/
Steam Smalls	15/-
Unscreened	21/6
Household	25/- to 30/-
DURHAM—	
Best Gas	23/- to 24/-
Second	20/- to 22/-
Household	25/- to 30/-
Foundry Coke	37/6 to 40/-

SHEFFIELD—	INLAND.
S. Yorks. Best Steam Hards	25/- to 26/-
Derbyshire Hards	24/- to 25/-
Seconds	23/- to 24/-
Cobbles	23/- to 24/-
Nuts	22/- to 23/-
Washed Smalls	17/- to 18/-
Best Hard Slacks	17/6 to 18/6
Seconds ,,	17/- to 17 6
Soft Nutty ,,	17/- to 17 6
Pea ,,	11 6 to 12 6
Small ,,	9/- to 10/-
House, Branch	39/- to 41/-
,, Best Silkstone	37 6 to 39/-
Blast Furnace Coke (Inland and Export)	22/6 to 27/6

(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	25/- to 25 6
Second ,, ,,	24/6 to 25/-
Best Dry Large	25/- to 25/6
Ordinary Dry Large	24 6 to 25/-
Best Black Vein Large	23 6 to 24 -
Western Valley ,,	23/- to 23 6
Best Eastern Valley Large	23/- to 23/6
Ordinary ,, ,,	21/6 to 22 6
Best Steam Smalls	18/- to 19/-
Ordinary ,,	12/6 to 17/6
Washed Nuts	35/- to 40/-
No. 3 Rhondda Large	29 - to 30/-
,, ,, Smalls	20/- to 21/-
No. 2 ,, Large	23/- to 24/-
,, ,, Through	20/- to 21/-
,, ,, Smalls	15/- to 16/-
Coke (export)	32 6 to 37 6
Patent Fuel	25/- to 28 -
Pitwood (ex ship)	35 - to 37/6
SWANSEA—	
Anthracite Coals:	
Best Large	57/6 to 60/-
Seconds	50/- to 52/6
Red Vein	47/6 to 50/-
Big Vein	50/- to 52/6
Machine-made Cobbles	72/6 to 75/-
Nuts	72/6 to 75/-
Beans	58/6 to 60/-
Peas	20/- to 22/-
Breaker Duff	7 9 to 8/3
Rubbly Culm	11/- to 11/6
Steam Coals:	
Large	24 - to 25/-
Seconds	23/- to 24/-
Smalls	12 6 to 16/-
Cargo Through	20/- to 22/-

(1) Delivered (2) Net Makers' works. (3) At furnaces. (4) Delivered Sheffield (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—F.O.B. Glasgow.

(8) Except where otherwise indicated coals are per ton at pit for inland and f.o.b. for export and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b.

French Engineering Notes.

(From our Correspondent in Paris.)

Trade with France.

ANYTHING which may develop business with France must help in the general recovery of international trade, and it is certain that if facilities were offered the exchanges between France and Britain would increase satisfactorily, despite the difference in monetary values. The costs of production in Britain appear to have been reduced in a much greater proportion than in this country, with the result that the disparity has been lessened sufficiently to permit of certain British goods being sold in France, if only they were not burdened by heavy import duties and more especially by the prejudice which continues to exist against the purchase of anything from countries in which the exchange rate is against French buyers. Despite the critical state of national finance, the country's purchasing power is still high, but the prejudice caused by the exchange rate is being taken advantage of to favour national production, which is apparently to be further protected by the coefficients. The law authorising the Government to modify the coefficients according to the requirements of industry is being prolonged until January 1st, 1923. That law is strongly objected to by a large section of economists, who insist that the welfare of France depends upon trade with foreign markets, and in order to give them partial satisfaction it is announced that the Government has the power to reduce the coefficients as well as to increase them. Evidently, however, there is no intention yet of imposing lower coefficients, for during the past week they have been further increased for certain goods, such as iron and steel wire and nails. Strong objection is raised against the unstable character of the coefficients, which may be modified at any moment, and are therefore detrimental to foreign trade; but so long as manufacturers clamour for protection they will probably get it, unless some compensation is offered by foreign countries in return for concessions.

Fuel Economies.

The necessity of reducing as much as possible the expenditure on imported fuel has led to official encouragement being given to the invention of fuel-saving devices, many of which were shown in the exhibition held in the Grand Palais. The exhibits were larger and, on the whole, more interesting than those of last year, but there was nothing that marked a distinct advance in heat engineering. Obviously, nothing can be done beyond making the best use of the combustion gases and of utilising every kind of fuel, however poor it may be; and it is certain that in this respect it has become possible seriously to reduce the purchases of foreign coal. The exhibition was devoted almost entirely to domestic heating, and, curiously enough, the greater part of the appliances were devised for the slow combustion of wood, under the impression that that fuel must be necessarily cheaper than coal or anthracite. As a matter of fact, wood is expensive, and with its more extended use the cost would increase. It is probable that for the same expenditure anthracite will give out more heat units than wood. There were numerous devices for recuperating heat in oil and gas stoves, and further economies were suggested in machines for separating small coal and slack from slag heaps, burning all kinds of refuse in suction gas plants, and in making briquettes from sawdust and vegetable refuse. All this was done during the war, when fuel in any shape or form was scarcely obtainable, and it does not appear as if the results were uniformly satisfactory. Experience has shown that so long as coal is obtainable at a fair price there is little demand for briquettes or for any of the "poor fuels" that have been placed on the market. The future for coal substitutes does not therefore appear encouraging, but real progress has certainly been made with the better utilisation of the fuel in appliances designed to radiate as much heat as possible.

Coal Dispute.

The competition of English coal in the Pas de Calais has resulted in a serious dispute between colliery owners and the men. At this time of the year the stocks of coal are usually very low and prices remunerative, but for the first time the colliery companies find themselves with a heavy accumulation of stocks which they are unable to sell because they cannot accept the prices at which English coal is being delivered in the district. At first it was supposed that the consignments of cheaper coal from England were due to an off-loading of stocks that would soon be exhausted, when the competition would lose its severity; but there does not appear for the moment any hope of a rise in the values of imported fuel, with the result that the coalowners have had to appeal to the men to accept lower wages to avoid the shutting down of pits. They state they are ready to prove that at the prices regulated by imported coal they are unable to make any profit at all. The men's union has refused to accept any wages reduction, and the advisability of closing down the pits until the stocks are cleared off is to be considered at an early meeting of the Coalowners' Association

Railway Rates.

The increases in railway rates about two years ago had the effect of putting up manufacturing costs to such an extent that a strong agitation has since been carried on in all industrial centres in favour of some immediate relief. Partial satisfaction was given to them in allowing a certain rebate on the freights for export, as well as on the carriage of some classes of raw material; but the concession was wholly insufficient, and the railway companies have therefore been required by the Government to prepare a revised scale of charges for raw material. As some considerable time may elapse before the revised scale is ready, the Minister of Public Works has authorised the railway companies to increase the rebate on metallurgical goods for export from 25 to 40 per cent. At the same time raw material sent to works over a distance of more than 100 kiloms. will be subject to a reduction of 15 per cent. on the existing rates.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

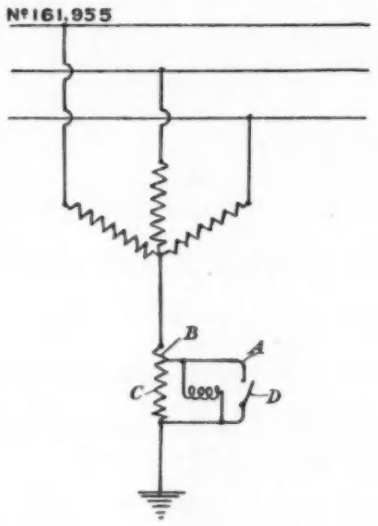
Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

DYNAMOS AND MOTORS.

161,955. April 16th, 1921.—IMPROVEMENTS IN THE ARRANGEMENT OF NEUTRAL POINT RESISTANCES FOR EXTRA HIGH-TENSION TRANSMISSION SYSTEMS Allmänna Svenska Elektriska Aktiebolaget, Västeras, Sweden.

THE object of this invention is to arrange the neutral point resistance of an alternating-current system in such a way as to combine the advantages of high magnetic reactance under normal working conditions with those of low magnetic reactance when an earth fault occurs. The three-phase windings of a generator

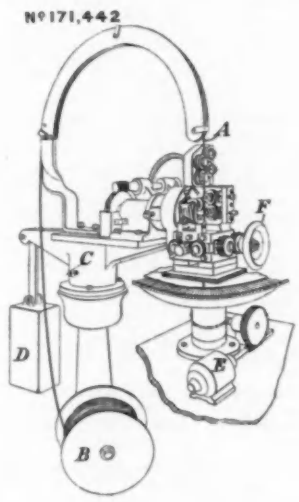


or transformer are shown star connected in the usual manner, and between the neutral point and earth there is an inductive resistance, divided by the local circuit A into two portions B and C. When an earth fault occurs the operating coil of the switch D is subjected to a rise of potential and automatically short circuits the portion C of the resistance. Two alternative schemes are also described.—*December 8th*, 1921.

ELECTRIC WELDING.

171,442. July 16th, 1920.—IMPROVEMENTS IN AND RELATING TO APPARATUS FOR ELECTRIC ARC WELDING, The British Thomson-Houston Company, 83, Cannon-street, E.C.

This specification, which describes a considerable amount of detail, relates to a machine for continuously feeding an electrode A into the welding arc so as to enable the work to be carried out in a perfect manner. The electrode is fed from a reel B on to the work, which in the case illustrated is a ring of turbine

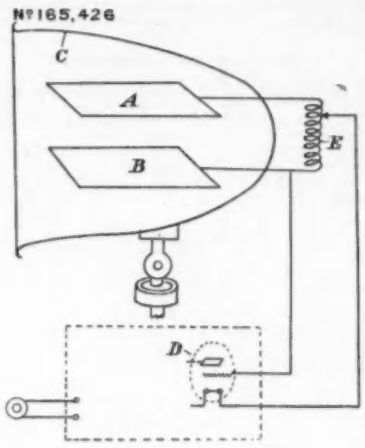


blading. By loosening the set screw C the welding head, which is balanced by a weight D, may be adjusted in a horizontal plane to any desired position. Means are also provided for adjusting the head along the base so as to vary the distance of the head from the pedestal. The motor which drives the feed rollers through the gearing to be seen at the back of the machine, is shown at E. A hand wheel F is provided to enable the starting of the feeding operation to be assisted by hand. The feed rollers may be adjusted to accommodate various sized electrodes.—*November 16th*, 1921.

WIRELESS TELEGRAPHY.

165,426. June 26th, 1920.—IMPROVEMENTS IN AND RELATING TO ELECTRO-MAGNETIC WAVE RECEIVING ARRANGEMENTS, Société Française Radio-Electrique, of 75, Boulevard Haussmann, Paris, France.

The receiving apparatus described in this specification is composed of two parallel plates A and B, which can be formed of networks or trellis of wires, and these plates are enclosed in a rotatable direction cage C, which is provided with an opening so as only to allow the plates to be influenced by waves coming

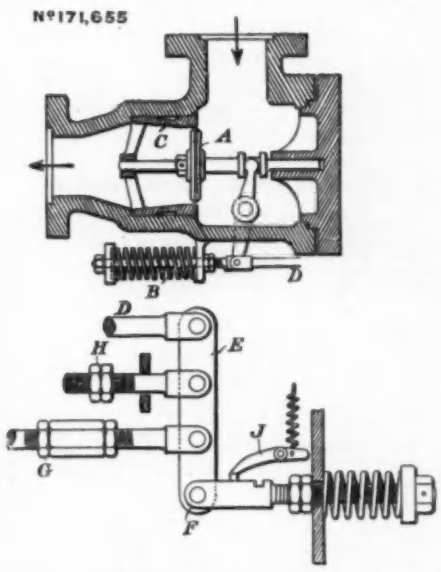


from a given direction. D is an amplifier and E an inductance.—*November 26th*, 1921.

TRANSMISSION OF POWER.

171,655. April 16th, 1921.—HYDRAULIC ENGINE GOVERNORS, H. Hunter, 1, Manor-terrace, Tynemouth, Northumberland.

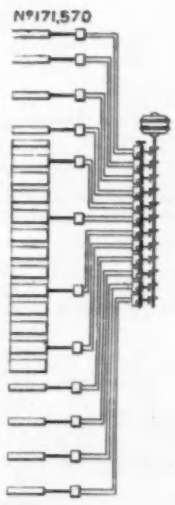
This governor is intended to regulate the supply of steam to an engine in accordance with the flow of water from a hydraulic pump it is used to drive. The water flows through the governor valve, as shown by the arrows, and in doing so moves the piston A, against the spring B in the conical passage C, to a



position which depends upon the rate of flow and the strength of the spring. The rod D rocks the limb E about F and operates the steam valve by means of the rod G. In the event of the engine running away the link E is moved so far that the stop H comes against its abutment and F is pulled out against its spring. The catch J then drops into its notch, and keeps the steam valve closed.—*November 24th*, 1921.

171,570. September 28th, 1920.—DRIVING PAPER MILLS, L. Miller, White House, Old Hall, Whitefield, Lancashire, and the Metropolitan-Vickers Electrical Company, Limited, 4, Central-buildings, Westminster.

According to the invention, the various rotary elements of a mill are divided up into a number of groups or sections which are



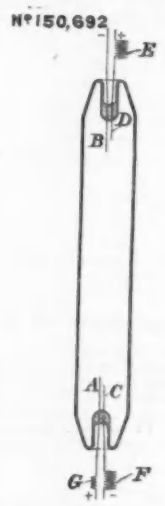
individually rotated each by a motor member of a rotary hydraulic or oil transmission gear, all the pumping members of the transmission gears being driven from a common source of power. The speed of all the groups or sections of rolls is altered

either by collectively adjusting the delivery of all the pumping members of the hydraulic gear or by varying the speed of the source of power, or by both these methods. The speed of individual sections is altered by adjusting the delivery of the associated hydraulic transmission members. This may be effected either at the pumping or motor members of the transmission gear or both. The drawing is self-explanatory.—*November 24th*, 1921.

LIGHTING AND HEATING.

150,692. August 27th, 1920.—IMPROVEMENTS IN OR RELATING TO ELECTRIC DISCHARGE LAMPS, Hendrik Filippo, Dirk Lely, jun., and Naamlooze Vennootschap Philips' Gloeilampenfabriken, all of Eindhoven, Holland.

The glow discharge lamp described in this specification differs from an ordinary lamp of this description in that in addition to the two main electrodes A and B there are auxiliary electrodes C and D, and between the main electrodes and auxiliary electrodes

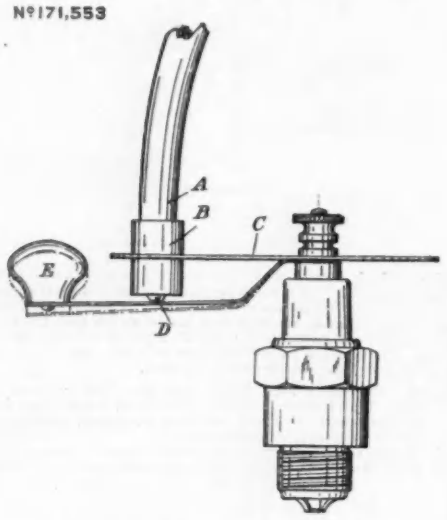


a discharge takes place all the time the lamp is at work. The advantage of the arrangement is that, owing to these secondary discharges, the lamp can be set to work by merely switching on the current in spite of the fact that the main electrodes may be a considerable distance apart. Resistances are provided at E, F, and G.—*November 28th*, 1921.

INTERNAL COMBUSTION ENGINES.

171,553. September 10th, 1920.—IMPROVEMENTS IN AND CONNECTED WITH ELECTRIC IGNITION IN INTERNAL COMBUSTION ENGINES, Frank Herbert Richards, of 16, Manor Gardens, Richmond, Surrey.

The high-tension lead A passes through an insulating bush B which is supported by a plate C. The high-tension conductor

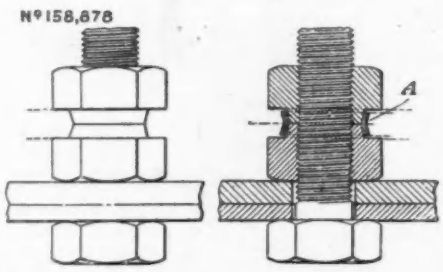


terminates at a contact D, and on pressing the knob E a spark gap is formed at D which discloses the fact if the plug is faulty.—*November 24th*, 1921.

MISCELLANEOUS.

158,878. February 3rd, 1921.—LOCK NUTS, L. Badois, 212, Avenue Pereire, Paris, and D. Kahn, 80, Avenue des Fernes, Paris.

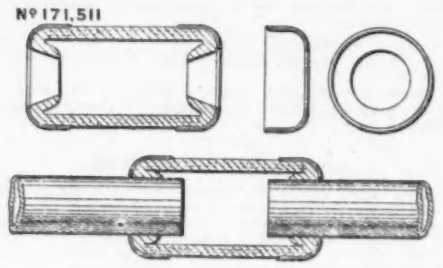
The inventor turns down the adjacent faces of check nuts to form short-tapered spigots and provides a collar A, of soft



steel, having a diameter slightly less than that of the spigots, so that it is deformed when the nuts are screwed together and grips them tightly.—*November 24th*, 1921.

171,511. August 27th, 1920.—PIPE JOINTS, H. S. Hele-Shaw and E. Tribe, 64, Victoria-street, Westminster, London, S.W. 1.

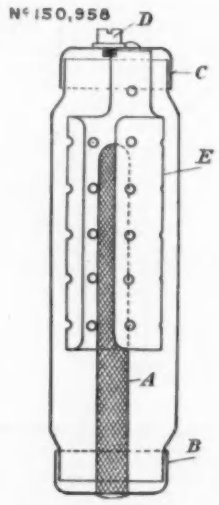
This specification covers a development of the Victaulic pipe joint, of which the principle is fairly obvious in the drawing.



The central portion of the leak-proof joint ring is reinforced, or stiffened, by canvas, and metal caps are fitted over the ends.—*November 24th*, 1921.

150,958. September 9th, 1920.—AN IMPROVED ELECTROLYTIC RECTIFIER CELL, Johann Kremenezky, of Nos. 55/57, Dresdnerstrasse, Vienna XX., Austria.

The electrolytic rectifier cell described in this specification is intended mainly for telegraphic and telephonic railway signalling installations. The aluminium electrode A is fixed to a cap B which is cemented to a glass container. The perforated iron



electrode E which surrounds the aluminium electrode is fixed to an upper cap C which is also cemented to the glass container, and a screw plug D serves for closing the container during transport. The connections are made on the caps C and B and the cell is filled with the usual electrolyte which is covered with a layer of oil.—*December 8th*, 1921.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME and PLACE at which the meeting is to be held should be clearly stated.

TO-DAY.

JUNIOR INSTITUTION OF ENGINEERS.—Caxton Hall, S.W. Lecturette, "Stone and Marble-working Machinery," by Mr. A. E. Bingham. Lantern. 8 p.m.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, S.W. 1. Joint meeting with the Society of Chemical Industry. "The Co-operation of the Engineer and Chemist in the Control of Plants and Processes," by Mr. G. M. Gill. 6 p.m.

INSTITUTION OF LOCOMOTIVE (MANCHESTER) ENGINEERS.—College of Technology, Sackville-street, Manchester. "Notes on the Influence of Design on Express Locomotive Performance," by Mr. C. J. Allen. 7.30 p.m.

SATURDAY, JANUARY 7TH.

INSTITUTION OF LOCOMOTIVE ENGINEERS (SCOTTISH CENTRE).—Ball Room, Grosvenor Restaurant, Glasgow. Smoking concert. 6.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—Albemarle-street, W. 1. Children's lectures: "Electric Waves and Wireless Telephony." Lecture V., "Creation and Detection of Electric Waves." 3 p.m.

SATURDAY, JANUARY 7TH, TO SATURDAY, JANUARY 14TH.

THE MODEL ENGINEER EXHIBITION.—Royal Horticultural Hall, S.W. 12 till 10 p.m. daily.

MONDAY, JANUARY 9TH.

INSTITUTION OF ELECTRICAL ENGINEERS.—Savoy-place, Victoria Embankment, W.C. 2. Informal meeting. Discussion on "Co-operative Advertising in relation to the Electrical Industry," to be opened by Mr. J. W. Beauchamp. 7.30 p.m.

INSTITUTE OF TRANSPORT.—Institution of Civil Engineers, Great George-street, S.W. 1. Paper, "Transport Law," by Sir R. Francis Dunnell. 5.30 p.m.

BRADFORD ENGINEERING SOCIETY.—Hall of the Bradford Technical College. Joint meeting with the Yorkshire Association of the Institution of Civil Engineers. Lecture "The Bradford Water Supply," by Mr. Lewis Mitchell. (Lantern.) 7.30 p.m.

TUESDAY, JANUARY 10TH.

JUNIOR INSTITUTION OF ENGINEERS.—Visit to Charlton Works of the United Glass Bottle Manufacturers, Limited, at 2.30 p.m.

SHEFFIELD ASSOCIATION OF METALLURGISTS AND METALLURGICAL CHEMISTS.—Assembly Room, Royal Victoria Hotel, Sheffield. Annual general meeting. 7.30 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS: SCOTTISH CENTRE.—North British Station Hotel, Edinburgh. Paper, "Induction Type Synchronous Motors," by Mr. L. H. A. Carr. 7 p.m.

THE INSTITUTION OF CIVIL ENGINEERS.—Papers to be read:—"Control of Trains in relation to Increased Weight and Speed Combined with Reduced Headway," by Mr. Alan Wood Rendell; "Trials in Connection with the Application of the Vacuum Brake for Long Freight Trains," by Sir Henry Fowler, K.B.E., and Mr. Herbert Nigel Gresley. 6 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—Albemarle-street, W. 1. Children's lectures: "Electric Waves and Wireless Telephony." Lecture VI., "Wireless Telephony by Electric Waves." 3 p.m.

INSTITUTE OF METALS: SCOTTISH LOCAL SECTION.—Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank-crescent, Glasgow. "Internal Stresses in Metals," by Dr. A. McCance. 7.30 p.m.

MANCHESTER GEOLOGICAL AND MINING SOCIETY.—Queen's Chambers, 5, John Dalton-street, Manchester. Lecture, "The Ancient Rocks of Anglesey Known as the Mona Complex," by Dr. E. Greenly. (Lantern.) 4 p.m.

JUNIOR INSTITUTION OF ENGINEERS: MIDLAND SECTION.—Birmingham Chamber of Commerce, New-street. Paper, "Drop Forgings," by Mr. J. Fearn and Captain F. W. Spencer. 7 p.m.

WEDNESDAY, JANUARY 11TH.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Institution of Mechanical Engineers, Storey's-gate, S.W. 1. "An Investigation of Certain Aspects of the Two-stroke Engine for Automobile Vehicles." 8 p.m.

THE INDUSTRIAL LEAGUE AND COUNCIL.—Caxton Hall, S.W. 1. "A Fair Day's Work for a Fair Day's Pay," by Mr. Robert Stelling. 7.30 p.m.

INSTITUTION OF CIVIL ENGINEERS.—Great George-street, S.W. 1. Students' meeting. The first of two lectures on "The Economic Aspects of Various Methods of Power Transmission," by Mr. E. W. Monkhouse. 6 p.m.

ASSOCIATION OF ENGINEERS-IN-CHARGE.—St. Bride's Institute, Bride-lane, Fleet-street, E.C. 4. Paper, "Machinery for the Production and Refining of Edible Oils for Margarine, &c.," by Mr. B. P. Flockton. (Lantern.) 7.30 p.m.

LIVERPOOL ENGINEERING SOCIETY.—Royal Institution, Colquitt-street, Liverpool. "Wireless Telegraphy in the Mercantile Marine," by Captain J. A. Slee. 8 p.m.

THORNYCROFT ENGINEERING SOCIETY.—Works Canteen, Basingstoke. "Wireless Telegraphy," by Mr. J. Doust. 7 p.m.

THURSDAY, JANUARY 12TH.

ROYAL AERONAUTICAL SOCIETY.—Royal Society of Arts, John-street, Adelphi, W.C. 2. Annual Juvenile Lecture. Talk on "Boats that Fly," by Major D. C. H. Hume. 3 p.m.

THE OPTICAL SOCIETY.—Imperial College of Science and Technology, South Kensington, S.W. 7. The following papers will be presented:—"The Manufacture of Optical Glass," by Dr. C. J. Peddle; "The Barr and Stroud 100ft. Self-contained Base Range-finder," by Dr. James W. French; "The Optical Three Apertures Problem," by Mr. T. Smith. 7.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—Official Visit to the Model Engineer Exhibition at the Royal Horticultural Hall, Vincent-square, Westminster, at 6 p.m.

INSTITUTE OF METALS: LONDON LOCAL SECTION.—Sir John Cass Technical Institute, Jewry-street, Aldgate. "The Inner Structure of the Crystalline Grain," by Colonel N. Belaiew. 8 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS.—Savoy-place, Victoria Embankment, W.C. 2. Exhibition of cinematograph films: (*a*) "Investigations and Tests on High-tension Switchgear," by Mr. P. Torchio, with explanatory notes by Dr. C. C. Garrard; (*b*) "Telephone Inventors of To-day," exhibited by Mr. F. Gill; (*c*) "The Audion," exhibited by Mr. F. Gill; and if time permits, (*d*) "Electricity in the Home," exhibited by Mr. F. Gill. 6 p.m.

FRIDAY, JANUARY 13TH.

JUNIOR INSTITUTION OF ENGINEERS.—Caxton Hall, Westminster, S.W. 1. "Artificial Ice," by Mr. E. C. West. 8 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—Lecture Theatre, Literary and Philosophical Society, Westgate-road, Newcastle-on-Tyne. "The Use of Compressed Air in Diesel-engined Ships," by Mr. Wm. Reavell. 6.30 p.m.

MANCHESTER ASSOCIATION OF ENGINEERS.—Memorial Hall, Albert-square, Manchester. Discussion, "Shop Management," to be introduced by Sir Henry Fowler. 7 p.m.

ASSOCIATION OF ENGINEERING AND SHIPBUILDING DRAUGHTSMEN.—University Engineering Building, Liverpool. "The Vyrnwy Aqueduct," by Mr. F. W. Gaskin. 7.30 p.m.

SATURDAY, JANUARY 14TH.

INSTITUTION OF BRITISH FOUNDRYMEN.—College of Technology, Manchester. Annual Dinner. "The Solution Theory of Alloys, with special reference to Cast Iron," by Dr. F. J. Brislee. 4 p.m.

TUESDAY, JANUARY 17TH.

INSTITUTE OF METALS: BIRMINGHAM LOCAL SECTION.—Chamber of Commerce, New-street. "The Influence of Time and Temperature on the Properties of Alloys," by Professor C. A. Edwards. 7.30 p.m.

THURSDAY JANUARY 19TH.

INSTITUTION OF CIVIL ENGINEERS (YORKSHIRE SECTION).—Gt. Northern Rly. Hotel, Wellington-street, Leeds. First Annual Dinner. 6.30 for 7 p.m.

FRIDAY, JANUARY 27TH.

FINSBURY TECHNICAL COLLEGE OLD STUDENTS' ASSOCIATION.—The Engineers' Club, Coventry-street, W. Smoking concert and informal dinner. 7 p.m.

TUESDAY, JANUARY 31ST.

INSTITUTION OF CIVIL ENGINEERS: MANCHESTER AND DISTRICT ASSOCIATION.—Paper on "Tidal Power Development," by Professor A. H. Gibson, D.Sc. 6.30 p.m.

DUTCH INTERNATIONAL INDUSTRIES FAIR.—The sixth annual Dutch Industries Fair will be held at Utrecht from February 21st to March 3rd, 1922, and it will, as was the preceding one, be open to international trade. It will be held in temporary wooden sample rooms in two neighbouring squares in the centre of the city, as well as in the permanent fair building in Vredenburg-square. Further information may be obtained by application to the Organising Secretary (Exhibitions Section), Federation of British Industries, 39, St. James's-street, London, S.W. 1.